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THE LAWS
OF LIFE

J. L. MILTON



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THE LAWS OF LIFE

AND

THEIR RELATION

TO

DISEASES OF THE SKIN

BY

J. L. MILTON

SENIOR SURGEON TO AND LECTURER AT ST. JOHN'S HOSPITAL
FOR DISEASES OF THE SKIN

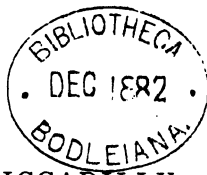


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CHATTO AND WINDUS, PICCADILLY

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PREFACE.

THE following lectures were delivered at St. John's Hospital in June last, and are now reprinted almost word for word, no change of importance having been made intentionally.

I am continually asked to what some particular disease of the skin is due, and therefore gladly embrace the opportunity of issuing a work to which I can refer the inquirer, who, when he has mastered the contents of this pamphlet, knows as much as I know myself.

The first brief outline of the work formed the subject of one of my earliest productions, a paper in the *Medical Times*. One particular reason for mentioning this is, that since then, two medical men of considerable eminence have put forth views, in substance very similar to one or two of those in the memoir just alluded to ; not merely in total ignorance of it, but, as well as I can make out, of each other's claims.

Free use has been made of the last resource of medio-

crity, italics ; the object being to awaken attention, and, if possible, enforce conviction, I thought and still think it quite legitimate to grasp at any means which promised to assist the purpose in view. Should the reader consider that in aiming at this, the opinions of other writers have been passed over in too cursory a manner, or even perhaps unfairly dealt with, I at once admit that he is most likely right, and that I have nothing to urge in extenuation. To such censure I must submit. It is very probable indeed that the line of argument taken up is rather that of special pleading than of strict justice ; for I do not seek to conceal the fact that I am biassed in favour of the theory advocated in these pages, and I will make no profession of an impartiality which I do not feel.

18, *Suffolk Street, Pall Mall, S.W., and*
Sion House, King's Road, S.W.



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LECTURE I.

Proposed Mode of Investigation ; Want of Authorities on the Subject ; Division of Structures into Groups ; Functions performed by these Structures. Theorem 1 ; Theorem 2. The vital-Power Theory. (a.) Evidence of Biography. Stature of eminent Men ; Small Families of eminent Men ; Difference of Character between Children and Parents ; Worse State of the next Generation ; Peculiar Features of Genius ; Choice of Names ; Great Growth of animal Life ; Great Activity of reproductive Powers ; Great Development of organic Life. (b.) Events of daily Life. The Cause of Waking ; Animal Life Current ; Brain Current ; Food Current ; Antagonism of these daily Currents ; Of animal Life Current to Brain ; Of Brain to animal Life ; Of Food Current to animal Life and Brain ; Of Food and animal Life Current to organic Life.

PROPOSED Mode of Investigation.—The first object of these lectures is to ascertain whether it is possible to construct such a fabric as a physiology of common life, and whether such a thing, when erected into a system, will yield us the means of solving some of the difficulties which beset all attempts to explain the pathology of skin diseases. I need scarcely say that if we look into text books and treatises for information about such a subject, we shall be egregiously disappointed. We may find almost any amount of dissertation about the breathing and circulation ; the secretion of bile and the chemistry of digestion ; about particulate matter and cells ; bacteria and micrococci ; section and stimulation of nerves ; but we scarcely meet

with more than a brief and passing allusion to the physiology of man's outward visible existence, of his growth and decay, his food, sleep and habits. The laws which reign over life and death, and under the influence of which genius is developed and the mind is connected with the external world, have been so little studied that I do not know a single work which treats of them. Yet without a thorough searching exploration of these points it would be impossible to work out the theory which I hope to lay before you.

I therefore propose to examine man, not as a subject for the dissecting table or scientific experiment, but as a living thinking being. I leave on one side all questions of anatomy and what is usually known as physiology. They have no more to do with the subject in hand than the study of the strata of the earth, or the chemical composition of its salts, would have to do with the theory of gravitation. The task before us will be to analyze man's life as revealed by the light of biography and simple observation, and I shall deal with little but plain facts which every one can verify or reject for himself. The subject matter will no doubt seem humble enough to those who can only realize physiology when issuing from the professor's chair, but I think the method will be found to have in it what Johnson inadvertently called "a bottom of good sense," and believing as I do that science is on the side of nature, which really means common sense, I shall take the liberty of assuming that if I can keep to the latter, I may be on the way to science itself.

Want of Authorities on the Subject.—With little if anything in the shape of precedent to guide me on the path,

without authorities to fall back upon, I must endeavour to show that certain inductions about the topics just mentioned, inductions quite at variance with received views, seem warranted and that a theory of vital actions can be shaped out of them; and while I do not feel sure that I shall establish one single position, I know that I can only arrive at the goal by an intricate chain of argument. I must therefore ask your forbearance if I appear to be dealing at any time with irrelevant matters. I must beg of you to believe that it is not so; that every word I say has been weighed, that every fact imported into these lectures must have its allotted place or the argument would break down. I promise not to occupy one minute more of your time than I can help, to get at the pith of the matter as fast as lies in my power; but I dare not omit one word that is necessary. As the physiology of life, from the standing point taken up here, can only be read by the light which the aberrations of that life cast upon the dark and complicated page, so each variety of growth and function, abnormal and natural, which may bear upon the subject, must be interpreted in its turn, or the whole theory at once stands self-condemned as faulty. What is more, in an inquiry of this kind, which diverges so widely from accepted doctrines, it is necessary if possible to prove everything that is said, and indeed so to fortify it with evidence that it cannot be disproved. The positions taken up must be impregnable or they are valueless. There is no middle path. I do not say that I shall be able to effect all this, for no one can promise himself so much, but that I mean doing my best to effect it. I shall attempt all I can in the way of demonstration, and as accurately as I can,

and in the event of being thought to have made only an indifferent affair of it, console myself by remembering, that more than one system afterwards found stable enough, was at first viewed in a similiar light.

A case in point will perhaps best show the system of investigation to be pursued. When we see one man a towering monster like Patrick Cotter, another swelled out into such a mountain of flesh as Daniel Lambert, a third possessing a mind of almost divine stamp like Newton, solving at twenty four years of age some of the mightiest problems in physics, the object aimed at will be, not to describe the forms of internal growth which evolved these marvellous varieties, to learn why all this happens; but to find out what results to the individual, his health, life, mind and offspring when it does happen. If we turn for an elucidation to the recognized sources of knowledge, I suspect we shall generally find that such topics are ignored as below the dignity of science; for without going out of the way to be sarcastic, one may safely say that physiology like history is very apt to get on stilts, and once there to remain there. Her answers to inquiries about such common-place matters are usually what Faust calls "unrefreshing," and even if a reply were forthcoming, the explanation would bring us no nearer the mark; seeing that, with all deference to authorities physiology is not exactly on the right road for our present purpose. I say this quite advisedly. I believe there is not, in any physiological work, one scrap of evidence to show that the writer saw, in the aberrations of growth just mentioned, exemplifications of one great uniform law, the operation of which under

every variety of shape is always the same ; which visits with like result every excess of growth or function, and which, with ever varying intensity, is always alike in its mode of action.

Division of Structures into Groups.—If we take man then as a living sentient animal, we find that in virtue of these qualities he executes certain functions by means of organs or structures which naturally fall into distinct groups, in a state of constant antagonism to each other, and the study of what ensues, from preponderance of action in any of these groups, brings us face to face with the first of the problems we have to consider.

I need scarcely tell you that the famous Bichât divided the structures of the human frame into two great classes, those of animal life such as the muscles, eye &c., and those of organic life as the stomach, heart and so on. The arrangement has been more quoted than utilized, for I believe no attempt has been made to improve upon it, and by those who accept it, if any such there be, it is accepted as a whole. I speak doubtfully ; there may be works in which it is taken as a basis, but in the course of my own reading, I have seen only a few brief notices of it and those by authors who reject the method. Brodie is one of these. He considers it entirely theoretical, and never “likely to be practically useful, or to lead to any improvement in the science of physiology.” His ground for this judgment is that the functions, which Bichât separates, are closely connected with each other, and for those who consider physiology to be indissolubly linked with anatomy, the objection no doubt holds good. But in these lectures I have to deal

principally with functions and I therefore think it will answer to take Bichât's classification as a starting point but an inadequate one, and to divide the structures of the human frame into five groups. 1. Those of organic life. 2. The organs of animal life including those of sight, hearing &c. 3. The brain considered here only as an expansion of part of the animal life, and with special reference to that portion of it which is the seat of thought, wherever it may be. 4. The reproductive structures, and 5. Certain organs such as the spleen, thymus gland &c. the functions of which have not been made out, and of which therefore no farther notice will be taken, so that undivided attention may be given to the others. You will perhaps object to this classification as elementary and incomplete, but there is so much to be crowded into these lectures, that I must content myself with saying it will be easy to correct both deficiencies by referring to any anatomical text book, and that with the progress of the argument the purpose of the arrangement will come out more clearly into relief.

Functions performed by these Structures.—That the first four groups of organs execute certain offices is self evident, for we see some of the functions performed and others can be demonstrated. Life indeed is but an aggregate of such actions, and as action is inseparable from motion, there must be force. As I understand Dr. Burdon Sanderson, he would define all function as movement. But I only know of two forms of motion, that in which there is absolute translation of a body from one spot to another and the vibratory. It strikes me that he would be rather puzzled to refer thought and sensation to either form ; yet by a contra-

diction I am going to try if I can prove that all function is attended by motion, but of a different kind from that considered by him, it being the governing power which is first set in movement, not the material acted upon. It being admitted then that functions are performed and by means of a force, it will be requisite to expand this idea into a couple of theorems, which are absolutely necessary for a clear comprehension of what follows. It may be argued that this means taking something for granted which has not yet been proved, but it is no more so than the method of the arithmetician, all whose calculations are based on arbitrary starting points.

Theorem 1.—The first proposition is that excess in the performance of one function, or more than one, tends to induce deficient action in other organs; thus in some measure proving that the power, which sets in motion and controls the actions of the human frame, is limited in amount, and that it is a constant quantity as regards the whole, and a varying one as concerns particulars, on the principle of thrift.

Theorem 2.—The second is that this varying quantity of vital power in different parts is, in some measure, the key to a right interpretation of the phenomena of life.

The vital-Power Theory.—These propositions then, integral parts of a theory which follows, are in their various bearings the subject of our lectures, and all future observations will issue from them as the branches do from a tree. The theory itself, in which the foregoing theorems culminate, and which I have ventured to call the vital-power theory, is that the mind, soul and vital power are one and the same

thing ; that all our passions, thoughts and functions ; our growth, decay, and death ; disease, recovery and maintenance of health, are but so many manifestations of one force acting through different organs ; a force which is never regenerated and never decays, which is as insusceptible of increase, lessening, division or destruction as an atom of oxygen would be, and which is of the same magnitude and quantity in every human being of the same race ; that every hostile agent which can influence the human frame, from the lightning stroke to the miasm of the humid marsh, acts by attracting this power to the seat of impact, just as the magnet does the iron or as the moon attracts the ocean, and calling into play the ever ready antagonism of the different groups of structures ; and lastly that all doctrines about blood-poisons, ferments and germs, are either unsupported figments or relate to mere secondary matters. This I shall now endeavour to prove by A. Certain physical changes seen in individual man and his offspring. B. Events occurring, in everyday life. C. The phenomena of disease.

A. *Certain physical Changes seen in individual Man and his Offspring.*—The first part of the evidence is what I alluded to as drawn from biography, and embraces certain facts about eminent men and persons of large physical growth such as giants ; it may be summed up as follows :—
1. Great development of the powers of the brain is generally accompanied by only moderate expansion of the organs of animal life ; and when such a conjunction as high development of both is found, it is marked by shortness of existence or defective vitality in the structures of organic life, and

low organization of the frame. It is almost invariably associated with feeble reproductive power, the children of such parents being for the most part few and weakly and having few or no children. 2. On the other hand great size of the structures of animal life is connected with moderate development of the brain, and a feeble state of the structures of organic life and reproductive powers. 3. Unusual activity of these last is not attended by particular development of the brain, and sometimes by only moderate growth of the animal life. 4. Great development of the organic life is not known to exist unless it manifests itself in the form of longevity, and in this case is not seen in union with great development of the brain or animal life. The evidence in support of all this is as follows:—

Stature of eminent Men.—I took the biographies of a large number of celebrated persons, and after rejecting many such as those of Homer, Hesiod and Pindar, on account of the obscurity which surrounds their history, selected two hundred, and analyzed them as to the physical qualities of those whose lives I found recorded. Respecting fourteen, principally famous people of the classical ages such as Anaxagoras, Herodotus and so on, but some of them quite near our own time, for instance Shakspeare, Dryden and Cook, not a word is said on this head, and we can only assume that there was nothing very extraordinary or even the dullest of biographers would have spoken of it. The assumption is strengthened when we come to those cases where the stature is mentioned, for then we find nothing very unusual. Out of the remaining men a hundred and thirty seven were of moderate stature or short,

and only forty nine were above this ; even of the latter several were but little beyond the average height, so that I fancy we may conclude silence means mediocrity of size. The number of very tall men was found to be limited, few reaching six feet, and only two, Schiller and Peter the Great, much above this. More we cannot learn. Owing perhaps to the little interest they take in these matters, biographers, even of quite modern times, only favour us with such meagre and often conflicting accounts, that we can barely arrive at a rough computation. However sweeping such a charge may seem, I feel assured that any one who looks into the subject will bear me out. But enough is still found, I think, to justify the first postulate, and I now proceed to examine the second, which is that great expansion of the mind and animal life is attended by shortening of existence or defective vitality, and by low organization of the frame.

The average age then, at which eminent men of moderate size die is sixty five years and about four months and three quarters, whereas that attained by celebrities of large stature is only sixty two years and about eight months and a quarter ; and in the latter the standard of health often compares unfavourably with that of the other. From Alfred the Great down to Schiller the tale, when told at all, only too frequently repeats itself, while the physical defects of these men are sometimes painfully apparent ; and often, as one deathless name succeeds another, we seem to have before us rather a troop of invalids and cripples than ordinary people.

Small Families of eminent Men.—The next postulate is

that very celebrated men have few children, though not so few as might be inferred from the little said by those writers who touch upon the subject, and talk about genius "not reproducing itself." Here again we encounter the same difficulty as before in obtaining accurate information. One might think biographers would rather like to say something about a great man's children, but it is often enough not so, and some amusing instances of their negligence on this head might be quoted. For anecdotes however of any kind I have no time to spare; all superfluities, no matter how interesting, must be discarded. It will be enough to say that there are biographies, many of them justly looked up to as authentic, and in other respects complete, in which no mention of the children, not even the slightest allusion to such a topic, occurs; and others wherein the subject is touched upon, merely, it would seem, because it could not be avoided. More especially this is the case with the biographies in english cyclopædias and dictionaries, which are often far behind those of the French.

Out of the two hundred celebrities selected it is expressly stated of eighty five that they had no children at all, while as regards five more it is almost certain that they had none. Seventeen had only daughters, so that in more than half the entire number the male line was at once lost. Of the daughters too the number is remarkably small, there being only twenty one to the seventeen names; of these four died in infancy or quite young and four more died unmarried, childless, or before their fathers. To seventy four great names biographers have allotted a hundred and thirty eight sons and eighty three daughters; a disproportion which

must rather surprise those who remember that the census gives twenty one female to twenty male births. This disproportion, too, cannot be made up by adding the twenty one daughters, as there would still be on the male side an excess of more than twenty in the hundred. Part of the disparity however is speedily and fearfully rectified. Twelve of these sons met with violent deaths; twenty died in infancy or quite young, a fate shared by eight of the daughters. Fifteen sons and nine daughters died in early prime or before their fathers, and nineteen sons and six daughters unmarried or childless; so that at the close of little more than a generation, there were only seventy two sons and sixty daughters left to continue the race, or less than the original fathers and mothers. Of these great men I have only been able to make out that eighteen had grandchildren, and in six instances this happened exclusively through the daughters, while in at least two cases the house was extinguished in the next generation.

There remain nineteen names the accounts about which are in a state of the greatest confusion. Sometimes neither the number of children nor their sex is given, as in the case of Cook, Jenner and Holbein; at other times we find the number without the sex, or the sex without the number. Lastly, to complete the intricacy of the question, come instances where the sex of the family is only partially separated, as with Cortez who is said to have had one son, three daughters and several children. Consequently both numbers and genders are in the following computation somewhat arbitrary, and indeed I would gladly have left these men out altogether, but they are too great for that; and therefore,

calculating them as well as I could, I have allotted to the nineteen names a total of forty six sons and thirty nine daughters, numbers which contrast unsatisfactorily with those where we find exact statements, but interesting as showing that here too the sons preponderate over the daughters. Twenty six at least of those children died young, unmarried or childless, and out of the nineteen families it is only known that male descendants of two, those of De Foe and Jenner, have survived to modern times. In each case it was a solitary descendant, the last representative, and in each case said to have sunk into poverty.

Here then we have for these two hundred famous men only a hundred and eighty four sons and a hundred and forty three daughters, and so many of these perished off early, that at the death of the fathers there were only about a hundred sons and eighty six daughters left to perpetuate their race. And though their future history is so defective, enough remains to show that the decrease continued with the next generation, so that it is doubtful if we could assign to them more than sixty or seventy grandchildren. Now twenty five names taken from private life gave, as well as could be calculated, for it proved far more difficult than might be thought to get at exact numbers, forty four sons, fifty two daughters, forty grandsons, and sixty one granddaughters; while, judging by the census, the two hundred celebrities ought, looking to their great average age, on the lowest calculation to have yielded quite five hundred children.

Difference of Character between Children and Parents.—

The biography of our great men is fatal to the doctrine of descent. So far as this branch of investigation is concerned, the proprietor of the latest theory on the subject, whoever he may be, might retire from business and dispose of his stock of ideas to the highest bidder. Not only is great development of the intellect not necessarily hereditary, as according to some of Mr. Darwin's followers it should be, but the known instances, out of these two hundred names, of its being inherited do not amount to more than four and a half per cent., or nine in the two hundred, and only in five of these in a very marked form. So different indeed are very often the sons from the parents, that when we analyze the qualities which mark them we find that a large proportion break up into three great classes; 1, average talent or something lower; 2, an amiable but undecided turn of mind, sometimes extreme feebleness both of purpose and frame, gradually passing at the latest in the next generation into complete helplessness; 3, a perverse, stupid, or profligate disposition; the children of Titian, Bruce, Galileo and only too many others being notable examples of the last. Indeed the condition into which the descendants of many great men gradually lapse is not a pleasant theme to touch upon, but the prevalent opinions about descent, and still more those about the hereditary nature of diseases of the skin, forbid its being passed over. Yet by a singular contradiction, the daughters of these famous men seem to have been, save in respect to health, all that could be wished.

Worse State of the next Generation.—A large proportion of the grandchildren seem to disappear, almost directly and

in a most mysterious manner, from the arena of active life. The sons of renowned men have, as a rule, a fair start. Whatever the struggles of the father may have been, the children can usually command some influence and often a fair share of wealth. Thus favourably placed in the world their children ought to do well, but it is only too certain that, instead of this, a number of them manage to sink into poverty and insignificance and seem quite content to do so. As for the great fight of life they have no idea of it. While they can be surrounded by comfort and secured against the buffetings of the world, they may pass fair muster and some have even risen above mediocrity; but no sooner does a crisis come which fairly tests their powers than they break down, and even when subjected only to the ordinary trials of life, they soon cease to hold their own, and succumb to difficulties which resolute men would look upon as opportunities of earning distinction. Even in common life we constantly see the same thing. I do not say it is in any way the rule, for I am well aware that brilliant instances enough to the contrary could be cited, that many a famous man has sprung from a famous father or grandsire; but in proportion as the mental development acquires greater expansion in the parent, does such a fortunate succession occur more rarely, and does the result more fully exemplify in many instances the law in question. The principal point however before us is the interruption of hereditary descent, and I think I am quite warranted in saying, that in the offspring of those who hold the foremost places in actual life, who fill the largest spaces in the world's eye, there is, through a certain percentage of cases, a distinct and

unfailing tendency to difference and to difference for the worse.

Peculiar Features of Genius.—In these two hundred celebrities there are more handsome men than could be found in any crack regiment of equal number; and there are more oddities than would be met with in any two hundred taken promiscuously from the ranks of ordinary life. There seems to be nothing peculiar to genius in relation to physical beauty, except a disposition to run occasionally into extremes on one hand or the other. As to any characteristics revealed by the shape of the forehead or the lineaments of the face, I look upon them as pure inventions. We all know how much power of description has been expended in claiming our notice for the lofty and massive foreheads of so many illustrious men, with what eloquence Macaulay has written about the princely lines of Cromwell's face. The weak point of all this is that we never hear anything of it till the hero or poet has saved people the trouble of finding out that he was a genius, by the simple process of making his name known without the aid of their discernment. If we had such a description as Macaulay's, written while the subject of it was plain Mr. Cromwell, with apparently no greater object in life than stirring up the fenslodgers to resist drainage, then we could have understood that Nature had really stamped the impress of a soldier and statesman upon his face.

Unfortunately, too, for the theory of genius being revealed in the features, it is matter of notoriety that some of the shrewdest men of their day have been entirely deceived on this score. Few people possess more discernment than

experienced publishers and managers of theatres ; their existence may almost be said to depend on the exercise of this quality, yet these very men have over and over again refused works, which they would most certainly never have rejected could they have descried in the features of the applicant the prestige of coming celebrity. Indeed the character of some of our most renowned men has often enough been utterly mistaken in early life, one of the most noticeable instances being that related by Moore, where a gentleman, who saw Wellington playing with a quiz, predicted that the future hero of Vittoria and Waterloo would turn out a fool. Nor do I see too much reason to believe that the shape of the head or the cast of features offer any certain guide. Hugh Miller indeed describes, with all the beauty of diction we might expect from the historian of the Old Red Sandstone, the marks which characterize in common the heads of Cæsar, Washington, Cromwell and Wellington ; but as a matter of demonstration the reasoning should have been reversed. If Miller had, out of a great number of skulls all unknown to him, picked out these as possessing the characteristics which stamp a great soldier, then we should have known what to make of the argument. These very characteristics too have been wanting in men of the most indomitable energy and great warlike abilities, while every one of them might be found in people who have never risen above mediocrity. As for the size of the head it is no criterion, those of Newton and Byron being small. Nor can we trust to the weight of the brain. I have seen it stated that the brain of Dr. Abercrombie, an excellent physician, no doubt, but who cannot

be spoken of as a man of great genius, exceeded that of Thackeray, the great humorist, by eleven ounces, and that of Whewell, the philosopher, by more than fifteen; the latter being indeed more than two ounces below the average of sixty brains of ordinary persons as determined by Dr. Peacock. Consequently there seems to me ground enough for deciding that great genius may be considered as principally denoting excessive development of a function common to all of the more civilized races, excepting of course those born constitutionally imperfect; and that it has no more to do with external lineaments than the stomach which can digest any kind of food, and the heart which can go on beating for nearly a hundred years with unimpaired vigour, as we must suppose to have been the case with Titian, have to do with the outward form of the body.

Choice of Names.—You will perhaps ask who these two hundred celebrities are, and on what principle the selection was made. To the first question I reply that a list of two hundred names, with nothing to diversify the recital, would be far worse than the catalogue of the ships. As to the second common repute has been made the criterion of eminence. This may seem strange where so much profession of aiming at accuracy has been made, but really there is no other test. We cannot invoke the authority of critics, for no one of them has gone through such a series. If we ask the opinion of men of genius we get no better help. I believe there is not one of them, who has expressed an opinion on the matter, but has vehemently extolled some favourite artist or writer now sunk into com-

plete obscurity, and as vehemently decried some one whose great abilities the world has generally agreed to recognize. In short, taking the subject collectively, it may safely be said that there is no getting a rational opinion on it out of eminent writers.

Great Growth of animal Life.—But when we come to examine the results of unusual development of the osseous and muscular systems, which is after all unwonted functional activity in constructing these parts of the frame, we find still stronger illustrations of the theory; for not only is the effect upon the offspring much more noticeable, but a very material difference in the duration of life is observed. Under the term great growth of the animal structures are included here, not only unusual size of the bones and muscles, such as we see in giants, but also extraordinary development of the adipose tissue as in the case of Daniel Lambert and Bright of Maldon. The life of these persons is essentially short, but to secure exact particulars is not easy, no dates being given in many instances; however with scarcely an exception they one and all disappear so early from the scene as to make it pretty certain that those, of whom there is no account, share the fate of the few whose history has been recorded. Of some we are expressly told that they died quite young. In twelve cases where the date is stated, including Christoff Münster, most probably the biggest man of whom we have an authentic account, the Irish giants, Campbell, the Scotch giant, and Lambert, the average age is only thirty three years and two months. Even this is perhaps too high. The list includes Caius Maximin, emperor of Rome, of whom such exaggerations

are related that the wonder is how even the most credulous people could ever have believed them. His age is put down at sixty four, and he alone of all the twelve had a child, so that probability is quite on the side of there being some misstatement. The others were childless, and when to this we add their shortness of life, and contrast the double result with the much slighter effects produced by great mental development, I think we have strong evidence that the brain is only an offshoot from the animal life, expansion of which is attended by so much more serious consequences.

In those cases where a person dies young from an overgrowth of fat, Sir Thomas Watson attributes the fatal result, not to strain upon the system, but to deposit of adipose matter upon the heart. But such a process pre-supposes marked alteration of the pulse and cardiac oppression for some time previous to death, and this could not I fancy have been the case with Lambert, as he was quite well the night before he died, and had never in his life been ill. Besides it leaves unexplained the fact that extreme growth of bone and muscle is attended by the same curtailing of life. Possibly low development of the heart has something to do with the early death of giants, the animal system expanding at the cost of the organic. Brodie mentions the case of a lad six feet and a half high at sixteen years of age and growing rapidly, who died a few days after Brodie saw him, and whose heart was found to be so small that, to use the words of the illustrious surgeon, "it was manifestly inadequate to the functions it had to execute."

Great Activity of the reproductive Power.—That this is not

accompanied by particular development of the brain, and may be seen in conjunction with only moderate growth of the animal life structures, is not supported by much positive testimony, because the height of the fathers of large families is not usually mentioned; but in every case where I have got at anything like certainty, it ranged from five feet six to five feet eleven and the mother was small. Similar facts have been noticed with respect to the parents of very powerful men. Two eminent men, Sebastien Bach and Wieland, had large families. In no instance was excessive number of children traced through two generations; on the contrary such families sometimes manifested a strong tendency to dying out, very few of the children outliving the parents in some cases, and the children again of those few materially degenerating.

Great Development of organic Life.—As already remarked this is not known to exist unless it be in the shape of longevity; in this form however it to some extent supports the theory, for in the case of a man living to be extremely old, it was never found that he was of very large size or the father of a very numerous family; and with the solitary exception of Titian, of whom such an incredible account is given, extreme old age, that is to say a good deal about ninety, is scarcely ever found in combination with the highest intellectual powers. Possibly unusual tenacity of life under severe injuries may indicate great development of the organic system, but want of time will not allow me to offer any remarks on this head.

B. *Events occurring in everyday Life.*—The second part of the evidence to be laid before you is drawn from man's

daily life, and turns upon those actions which maintain his existence and connect him with the external world and the great human family. I propose to take the hour of waking as a starting point in the investigation. A beginning there must be, and I do not see that we can begin better than by choosing what is really the opening of the day to a sentient being.

The Cause of Waking.—The first question which meets us is why man wakes by daylight at all. I suppose the ready answer will be that his natural disposition, especially with respect to vision, peculiarly fits him to pursue his first occupation in the wild state, that of procuring food, by the light of day; and that the habits of savage life have been insensibly continued in his present state of existence. Granting a certain degree of weight to this argument, the next problem is what means Nature has adopted to effect the purpose. Evidently enough it is not the mere stimulus of daylight. Man does not naturally rise and retire with the sun; such a state of things never existed except in the dreams of the moralist. No traveller has as yet found a tribe regulating the time of waking and rest by the return and decline of the sun. In high latitudes man, living thus, would get scarcely any sleep at midsummer and do little else but sleep in the depth of winter. Yet he seems to conduct his movements there on the whole much the same as in other parts of the globe. He does not slumber the long winter away, and by another contradiction of a wide-spread opinion, many savage tribes frequently pass great part of the night in wakefulness.

But if rejected as a determining cause of waking, Nature

pretty evidently intended that daylight should be the companion of man's waking hours, and that the process which rouses him from slumber should so come into operation, that he must in his natural state pursue his labours chiefly by light, for she has made the latter as necessary to him as to the plant. Of this statement I think there is ample proof. Children, even when well fed, are, if reared in dark dwellings, not only more anæmic but more sickly and prone to deformity than those brought up on poorer food and sleeping in close and ill ventilated rooms, but supplied with plenty of light. There are so many facts in support of this that I might fill half the lecture with them, and I therefore spare you the trouble of hearing what must be well known to you.

I would suggest that the cause why man wakes is the return of the vital power from the organs of assimilation to those of the circulation and locomotion, to the brain and the structures concerned in receiving and digesting food; a return caused by the attraction of the parts for the vital power, this attraction in its turn being due to the organic necessity for supply of material to act upon, food in fact; a demand which requires for its fulfilment the presence of the vital power at the seats of action. This attraction evidently acquires greater tension in proportion as the supply is withheld. Observation will, I think, show the prime motive spring to be the requirement by every part in turn of a due supply of nutriment, and this want being felt in the organs of locomotion and digestion and in the brain, the vital power is attracted into them and waking occurs. Nature emphatically proclaims that every part, with the functions of which we are acquainted, shall take its share of work

It may rest sometimes or it may not, but it must bear its portion of the toil. Muscles condemned to inaction begin to waste, and probably a similar, though infinitely slower, change takes place in the brain, for men who do not exercise the power of thinking, seem in time to lose the faculty of doing so when they make the attempt. But the most imperious assertion of this law seems to be in respect to that organ which, more than any other, characterises the animal kingdom, that is to say the stomach. If food be withheld, in other words if rest of the viscus be enforced, mischief begins, evidenced by gnawing, pain, and finally insupportable maddening torture. I will not however trouble you with details familiar to all; I think we may safely assume that active exertion of normal function is essential to a healthy state of these structures, and if this be so, then the presence of a power is equally requisite, for where there is action power must be present. I need scarcely point out to you that it would have been a waste of force had Nature so arranged the human machine, that want of food was felt before the muscles, which supply the stomach with nutriment, and the brain, which guides the muscles, were roused to action, so that probably the coming desire for food is the prime cause of the triple flow of power to be presently mentioned.

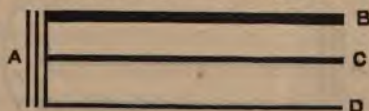
Many facts support the view that waking is independent of light, and due to some active physiological change. One of these is the morning rise of the pulse discovered really by Dr. Robert Knox, although Dr. Guy has erroneously been credited with the honour of priority. In connection with this stands the statement of Dr. Gregory that in all febrile

disorders there is a tendency to remission in the morning, and Dr. Prout found that more carbonic acid is formed in respiration from daybreak to noon than during the remainder of the twenty four hours. Counterpart facts, showing the depression of the organic life at an earlier period, will be noticed farther on.

Having then ventured to define as the cause why man wakes, the periodical determination of the vital power to those parts of the frame which demand its presence, I shall have at a later date to try if I can show that the work of assimilation goes on principally by night, when the structures towards which the force returns in the morning are more or less quiescent; and that, when it has accomplished the task of converting digested material into organized matter, it is set free. Meanwhile, what we have to consider is its movements at the time of waking, and these seem to be threefold; first towards the organs of animal life, secondly towards the brain, and thirdly towards the structures of organic life as represented by the stomach. The circulation and breathing do not come within the scope of these lectures. A diagram will perhaps best show what is meant by threefold movement.

Supposing the treble line A to represent the presence of the vital power at the seat of assimilation, wherever it may be assumed that this

FIG. I.
Morning Flow of vital Power, 6 A.M.

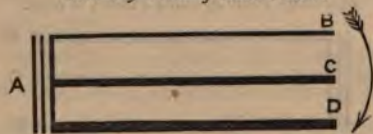


process is going on, then B may stand for the line flowing towards the organs of locomotion, C for the current going

to the brain, and D for that passing towards the organs of digestion.

Animal Life Current.—You will see that the current flowing towards the organs of locomotion is taken first and has the thickest line. The reason is that it is pretty clearly the first to be set in motion. The knowledge of this is so widely spread among the working classes that it might almost be spoken of as the result of instinct, it being well known that they, as far as they can, select the morning to begin work. I assume that this is due to there being at this time a maximum flow to the muscles. As day progresses more food is taken, and to digest it more vital power is attracted from the muscles and to the organic life structures. With the advance of evening the necessity for assimilating the digested food draws on; consequently more force is drained away to the organic life and the parts concerned in assimilation, so that less remains to animate the muscles, and later on the brain also, thus causing what is called fatigue, and gradually unfitting man for muscular labour and even the power of thinking. To show this process more clearly, let the first diagram be supposed to

FIG. 2.
Mid-day Flow of vital Power.



represent the flow of vital power at six o'clock in the morning, with the strongest current setting in towards the structures of animal life, the present one will give an

idea of the state at noon, the stream to these parts represented by B being narrowed, that towards the brain C

remaining the same, while that towards the digestive organs has materially increased as shown by the darker line at D.

Brain Current.—There is much more difficulty in fixing the time at which the brain current manifests its greatest activity. The power of thought is something so peculiarly superadded in the human race, its antagonism towards the animal life and reproductive structures is so much more marked than that towards the exclusively vital parts, and man possesses in so high a degree the faculty of using it at will, that it is not easy to get at the epoch of full normal power, and even the attempt to do so will seem impracticable to some persons. But for all that there are grounds for believing that its natural maximum follows close upon that of muscular action, and precedes activity of organic life, and that from then till the period for rest arrives the first and last, if not all three, are in opposition.

Looking to the normal state of matters, the usual practice of mankind, I think it will be found that few people can toil at the pen, or indeed any kind of headwork, so early as the labourer can begin his daily round; every attempt to do so has proved a failure. I tried the experiment for nearly three years and am satisfied that it was a great mistake. There can be little doubt, I think, from what Schwarzenberg says, that Humboldt, who at one time began his labours at four in the morning, had to abandon the method. Hunter to the last was a very early riser. Brodie tells us that he was constantly at work by five in the morning, but I apprehend it was principally the mechanical part of his vast labours, the dissecting, which he got through at this time. Here and there too we may find some industrious spirit like

Scott or Irving at his desk by seven or even earlier, but the practice is rarely kept up, and about eight or nine o'clock is as early a time as we can fix for natural activity of the brain, in England at least; the great mass of mental labour throughout the country being done after that hour and before five or six. So long too, as abstinence is not pushed so far as to bring on exhaustion, men who keep to the rule of getting through their work before dinner, stand it better than those who drudge at night. Many of our long-lived hard workers, such as Newton, Wellington and Wordsworth, have adhered to this plan; while on the other hand men like Byron and Schiller, who systematically pursued their labours into "the feverish hours of night," have sometimes had but a short run of it. Here too, as in the case of muscular labour, the supply of vital power to the structure at work, the brain, seems to abate with the increasing amount of food taken; a fact due, I suppose, to the augmented flow of power towards the organs concerned in the assimilation. In both cases man, by a powerful effort of the will can stay for a long time the ebbing tide of vital power; we constantly hear of men who have rowed ridden or walked many hours at a stretch; while some celebrities, Sir Thomas Lawrence, Scott and Voltaire for instance, have at times got through an almost incredible amount of work without stopping. But the hour of rest must and will come. Nature has fixed a limit beyond which the strongest frame and most resolute will cannot go, and then, the vital power no longer animating them, brain and muscles alike sink into sleep. All these points then duly weighed, I think we might fairly put the natural hour of waking at five to seven

in the morning, and the hour at which capacity for mental labour begins at seven to nine ; so that, really, activity of a specially developed part of the animal life follows the rousing up of the animal system itself. This awaking to life immediately precedes a great atmospheric and terrestrial change with which it is almost certainly connected. From eight to ten o'clock we have a maximum elevation of the barometer, a maximum electric tension, and the greatest maximum variation east of the magnetic needle.

Food Current.—As I have already remarked a third current sets in towards the organs of digestion, but more slowly than that supplying the brain and muscles. I consider the latter inference justified by the fact that man, as a rule, whether in his savage or civilized state, rarely if ever takes his heaviest meal directly after he rises. He may eat six times a day as used to be, and perhaps is now, the fashion in some parts of Holland, or he may imitate the example set by a once famous physician, who in his turn copied "that noble animal the lion," and restrict himself to one meal. He may be living in an air so stimulating to the appetite that he can breakfast on stewed partridges and peaches, and yet be hungry again in three hours, as I have been told is the case in the wilder parts of Kaffirland, or he may be pampering a half lost taste for food and ruining his liver in the enervating air of Hongkong or Calcutta ; but wherever he is or whatever kind of life he adopts, this law prevails, and all the customs of the table are regulated by it. Possibly it may be part of Nature's great scheme to approximate the time for taking the chief meal towards that when there is naturally the least amount of action in other parts to

interfere with its digestion and assimilation, a plan which also provides for the unimpeded exercise by day of those organs which enable man to seek food for himself and those dependent on him ; at any rate the almost instinctive tendency of mankind is to take the repast which demands the most power of digestion several hours after rising.

Antagonism of these daily Currents.—Now if it can be made clear that these currents are in opposition to each other, that increased action in one means lessened activity in the others, then the hypothesis of the vital power being limited will receive material support, and I believe this can be done. I consider there is evidence that the animal life is in opposition to the brain, and the latter to the animal system as represented by the muscles ; that when both these are taxed the capacity for digesting and even taking food is diminished ; and that in proportion as the stomach is stimulated by the bulk of the meal, the energy of the brain and muscular system abates. Now unless this means attraction *from* the one and *to* the other, I have laboured to little purpose.

Antagonism of animal Life to Brain.—I think there can be little doubt as to this part of the question ; we have only to examine the effects of muscular action, pushed to excess, on the functions, and especially the higher functions, of the brain. Immoderate exercise, if kept up, soon tells on the thinking powers. For instance, at the beginning of a long tour on foot the mind may be perfectly clear, there may be a feeling of fitness to cope with any subject, any problem ; but let the walk be continued day after day till weariness comes on, and it will be perceived that the brain

is becoming less adequate to the continuance of thought. If the walking be prolonged to the extent of bringing on great overpowering fatigue, it will, judging from my own observation, be noticed that a growing indisposition to think about any purely abstract matter is getting the upper hand. Or let the walking pace be increased, say from three miles and a half to four and a half in the hour; it will speedily be evident, when attention is given to the point, that it is almost if not quite impossible to keep the mind fixed upon an abstruse subject. But indeed any other form of exertion, even when so purely mechanical that no effort of the attention seems requisite for its due performance, will display the same result; so soon as it is carried to an extreme it interferes with the power of thinking.

Of Brain to animal Life Current.—If, as I have maintained, the brain be simply an expansion of part of the animal life, we ought to find that it does not exert so much control over the muscles as they do over it, and my contention will be that this is just what we do find. Still there is antagonism. We do not, it is true, get at much precise information, but such stray facts as turn up show that great intellectual efforts demand a certain inactivity of outward life, a withdrawal from the disturbing influences of the outer world. In some instances such as those of Brindley, Mozart and others, lying in bed is said to have proved the most favourable condition for the evolution of thought. Against this will be set the example of Montaigne, Addison and Napoleon, who found in a solitary walk the best help in getting their ideas into order. But this, instead of running counter to the law, is really an exemplification of it; the

walking in these men prevented over-concentration of the mind upon the subject. Too great or too long direction of the vital power to the brain, like too long diversion of it to any other part, fatigues and disturbs the natural actions, and this walking to some extent counteracts by occasioning partial withdrawal. A man, who pores over figures till his head gets heated, is rather apt to feel that he cannot go on with his work till he has had a walk to divert his thoughts for a while from the subject. Instinct teaches him, that if he carry the effort too far he will only embroil his brains, whereas rest, change of occupation or conversation will give his mind time to recover, and allow him to solve a difficulty which seemed hopeless. I therefore look upon it as a settled fact that too long attraction of the vital power to this, as to any other part, means deranged action which may end in mischief.

I will endeavour to explain by a diagram the idea which I wish to convey respecting the influence exerted on the brain by moderate walking. You may think this needless repetition, but if I am to prove that the positions taken up in this lecture are right, I must do it as I go along. There must be a clear impression as to each separate statement, however slight its structure, otherwise there can be no correct and complete idea of the whole argument. In the diagram then, 1, or the first set of letters, represents the brain, muscles and organic life in a state of equilibrium, no unusual strain being put upon any of the three. In the second set, 2, the increased action of the brain is represented by the thickening of the line at A, while the diminished action of the muscles is pointed out by the very opposite state of

FIG. 3.

Influence of Walking on Brain Current.

the line B; the organic life is supposed to be stationary as also in the third set, 3. In the latter again the lessened activity of the brain and increased flow of power to the muscles are represented by corresponding changes in the lines.

Of Food Current to animal Life and Brain.—A slight amount of attention, devoted to the subject, will show that, in proportion as more food is taken more vital power is withdrawn from the brain and muscles. After a heavy breakfast a man, otherwise ready for work, feels less fit to undertake it; and if he make a hearty dinner, he can scarcely rouse himself at once to a continuance of brain work. Should he, by an effort of the will, overcome the disposition which both muscles and brain show for rest, for instance by

using any violent exertion such as running, leaping, bathing &c., or by solving a complicated problem in algebra ; he is, in the first alternative, often made ill by what he could have borne with ease on an empty stomach ; while in the latter case he injures his health more slowly, but with equal certainty, in proportion as he continues the practice. Again weakly persons often feel chilled after dining in winter ; although while in health they make no complaint on this score, they constantly suffer when in a state of exhaustion. Now I hope to make it tolerably clear that weakness means, in every instance, not a decay or exhaustion of the vital power as we often hear, but a diversion of it ; and that not in a normal direction as happens in the phenomena we have been considering ; not towards organs whither we can trace it or fancy we can ; but towards some diseased or disordered part ; a theory, so far as I know, not even hinted at in any work.

Antagonism of animal Life and Food Currents to Rest of organic Life.—It appears to me equally clear that certain portions of the organic life may act in opposition to others, and in conjunction with another system ; and thus, while one vital organ is unduly stimulated, another may be deprived of the power to execute its natural functions. Among several instances of this Sir Thomas Watson quotes from Dr. Currie the story of a young man who had been playing a match at fives, and had violently heated himself. When it was over he sat down on the ground “ panting for breath and covered with perspiration,” that is to say he had exerted the organs of animal life till he was almost exhausted. “ In this state he called to a servant to bring him a pitcher of

cold water just drawn from a neighbouring pump. After holding it in his hand for a little while till he recovered his breath, he put it to his mouth and drank a large quantity at once. He laid his head upon his shoulder and bent forwards; his countenance became pale, his breath laborious and in a few minutes he expired." Now I think this narrative illustrates not only the antagonism of the animal life to the organic current, but another point at which I have only hinted, the possible opposition of even different parts of the

FIG. 4, 5, 6.

Antagonism of animal Life and Food Currents to Rest of organic Life.

4. *State of Equilibrium.* 5. *Excited State of animal Life System.*

6. *Excited State of Part of organic Life System.*

FIG. 4.

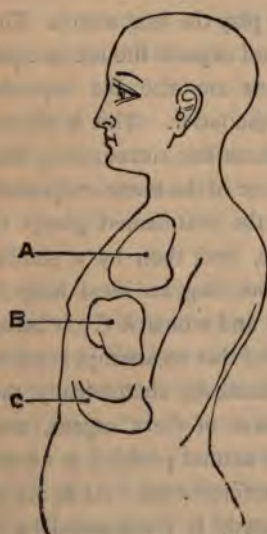


FIG. 5.



same system to each other, manifested here in different parts of the vital structure. Moreover, while I know of no physiological law which explains the mode of death in this case, I contend that the hypothesis of antagonism of force does account for the result, and very clearly. I concede unreservedly that the physiologist could array the case in a more scientific shape, and approximate it closer to the most modern doctrines of circulation and respiration, but with physiology as taught in schools I have nothing to do. In order then to see how far the theory will sustain its good character, I must ask your attentive consideration of the accompanying sketches, and the explanation which follows.

FIG. 6.



Let figure 4 represent the victim of this sad mistake before he had begun to play the fatal match. The animal and organic life are in equilibrium, as are also the separate parts of the latter. This is shown by a uniform line surrounding, first the contour of the frame and standing for the first-named group of structures, and then by a similar line surrounding an ideal lung A, heart B, and stomach C; it being understood that no attempt is made here to delineate anatomically the proper form of these organs, and that their natural position is necessarily interfered with. At figure 5 the animal life, violently stimulated, is represented by a

double line, one continuous and one dotted ; while the withdrawal of vital power, from the heart, stomach and lungs is shown by the breaking of the continuous line. Finally at figure 6 the vital power is shown attracted to the stomach by the action of the cold water, not only from the structures of animal life, but also from the already partially drained lung and heart. You will remember that the man's muscles yielded, and that his face grew pale ; then his breath became laborious and lastly failed. What all this can mean except deficient vitality in these parts I am at a loss to know. The necessarily increased, but secondary and irregular, action of the heart and lungs at figure 5 is left out from a desire not to make the description too complicated.

I will now quote from Sir Thomas Watson a case the very counterpart of this, that is to say where the stomach was acted on first and the animal life afterwards. It is that of a man killed, when drunk, by exposure to less than half the heat borne with impunity by persons who are sober. The man was a baker, and was found almost dead in an oven which he had entered when intoxicated ; he was taken to a hospital and died in a quarter of an hour. The heat of the oven was 120° . Now irrespective of much other evidence, we have the case mentioned by Pouchet of a girl who bore a heat of 284° Fahr., and the trustworthy experiments of Fordyce and Blagden, who exposed themselves both naked and with their clothes on to a heat of 240° and even 260° , "for a considerable time with very little inconvenience." Sir Thomas offers no suggestion as to the cause of death and therefore I will. It seems very probable that the vital power had been strongly attracted to the stomach

by the stimulants which the man had taken, and then, a still farther withdrawal being occasioned by the heat, sufficient did not remain in the organs of breathing, circulation and so on to carry on the work of life.



LECTURE II.

Assimilation of Food; Sleep; Changes in the animal Life during Sleep; Changes in the Brain during Sleep; Changes in organic Life Structures during Sleep; Night the Time for Death also; Explanations of Sleep; Necessity for Sleep; Fitful Returns of the vital Power. (c.) Disease and Death. Definition of Disorder and Disease. I. Will the Theory explain certain common Affections? I. Scarlatina as an Illustration. How does the Poison get into the Blood? What becomes of it after it has entered the Blood? Defective Evidence of the Presence of a Poison in the Blood; Actions like the specific produced without the Agency of a Blood-Poison; Tinea, in Reference to specific Action. II. Smallpox as an Illustration. III. Eczema as an Illustration. IV. Erysipelas as an Illustration. V. Common Inflammation as an Illustration.

ASSIMILATION of Food; Sleep.—We have now to consider a process of such importance that its execution seems to antagonize all the other three of which we have been speaking; for whatever the action we are coming to may be, it is accompanied by that more or less complete torpor of the frame which we call sleep. In order, however to make clear the observations which follow it will be necessary to propound a theorem, and this is that assimilation is the work of night, and the cause of natural sleep by withdrawing the vital power from the brain and muscles, as evidenced by the changes in the latter during sleep. These show that there is almost complete abstraction of vital power at such a time. Sights and sounds,

forms and movements, to which man would be attentive enough in waking hours are unheeded now. If the hand of a person in deep sleep be lifted without awakening him, it falls without an effort to stay the downward motion. If a loud sound, a strong odour, or bright light suddenly assail the organs of hearing, smell or sight, and be then withdrawn, a hasty exclamation, an uneasy movement or a fantastic dream, one and all often forgotten or only dimly remembered the next morning, are the only signs that we are dealing with a living frame; and but for these faint traces of impression the light might almost as well have fallen upon the eye, and the sound upon the ear, of the dead. If, without noticing intermediate grades, we turn to the period of life when we may suppose assimilation to be most active, that of infancy, we find that scarcely any sound will disturb slumber.

Changes in the animal Life during Sleep.—That this almost total cessation of activity takes place at night in the organs towards which we saw there was a threefold current setting in the morning, is, I submit, easy of proof; and it is interesting to notice that the ebbing of the vital power observes the same order as the morning flow, the muscles naturally resting first, the brain next and the stomach last, for the practice of taking a certain amount of food at supper time is an ancient and a natural one. The fact of this change ensuing almost throughout the structures of animal life is shown by what has just been related, which in itself gives evidence of a certain degree of torpor in these parts; also by the greater paleness of the skin and the lessened redness of parts attacked by certain forms of

inflammation ; perhaps as much as in anything in the diminished hue of some cases of *nævus planus* or mother's mark, a declension which begins almost as soon as sleep sets in. I had under my care too cases which exemplified this in a very marked manner. One of the patients was a little boy, with a *nævus* covering about half of the left eyebrow, the left side of the nose, and the inner half of the left side of the upper lip. To remove this mark some epispastic fluid was applied. The mother paid great attention to the treatment, and used frequently to look at the place when the boy was in bed. When the treatment had been continued some time, both she and the nurse noticed that after he fell asleep a white patch formed in the centre of the redness on the lip. In the other case the patient, a shrewd sensible girl, told me that after the blistering had been carried on some time, the part was much paler in the morning than it was at night.

Changes in the Brain during Sleep.—The phenomena mentioned in a former paragraph conclusively show that the torpor of the animal system is shared by the brain. Besides, during sleep man really makes no acquisition of learning, he neither thinks out the problems which had been puzzling him during the day time, nor does he digest down one atom of the knowledge previously picked up. He learns no more than when he slumbered in the womb, or when the elements of which he is made entered into the composition of other bodies. So far as normal function is concerned the brain seems to rest as completely as the muscles, added to which we have the fact that during night hours the misery, from which the victims of hallucinations suffer so

much by day, often spontaneously abates. If then we have visible evidence that both natural and morbid functions are suspended, it seems to me that there must be some strong counteracting agency at work.

But the brain undergoes physical changes during sleep. Mr. Durham gave chloroform to a dog, and while it was under the influence of the anæsthetic removed a portion of the skull, substituting for it a piece of glass. It was then found that while the dog slept the blood vessels were comparatively empty, and that the arteries lost their brightness, assuming the blue tint of the veins, while the brain collapsed, leaving within the skull a space which was filled with cerebral fluid. When the animal was awakened, that is to say when the vital power was attracted to the structures of animal life, the blood vessels resumed their functions and the brain once more filled the cavity.

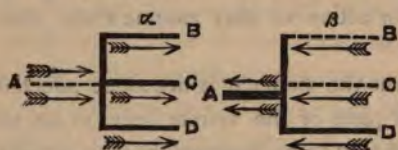
Changes in organic Life Structures during Sleep.—The evidence on which I would chiefly rely for sustaining this theorem is the inability of the stomach to digest a heavy supper properly. It will tolerate a light meal at this hour almost from the cradle to the grave, but the effect of a heavy supper is to show that the power of the viscus is now waning, and if the habit be pursued mischief is almost certain to ensue. I believe it is matter of almost universal experience, that the practice of taking the principal meal at night is sooner or later followed by great disturbance of the system; and that the digestion of an amount of food, borne with impunity in the day, has become by bedtime a task beyond the powers of the stomach. As sleep goes on this viscus becomes less and less capable of receiving food

or drink, till even a moderate quantity of water is hardly borne, in health at least. Persons who suffer much from thirst during the night generally find that, to quench it without bringing on a very uncomfortable sensation, they must limit the amount of fluid which they drink. Then, where there is less capacity for action we may assume there must be less power present.

But of the vital organs the stomach is not alone affected in this way; the other parts of the system seem to be all more or less influenced and to be lessened in their activity during sleep. The circulation sinks, to rise in the morning, possibly because by that time the work of assimilation has drawn to a close. The breathing slackens and is often performed with labour. The larynx and bronchi, the cesophagus and fauces, become so insensible to the accumulation of mucus which would at once irritate them during waking hours, that no effort is made to get rid of the encumbrance. The secretions are lessened, the nervous power, as it is called, is diminished. The portions of the gastro-pulmonary and urinary tracts more immediately constructed for reception and expulsion, perhaps from their being thus intimately connected with the animal life, appear to be more affected by sleep than the internal organs, for while the former seem quite torpid, the breathing, though with abated speed still goes on, the stomach digests a certain amount of food, perhaps at half the rate it does in the daytime, and the vermicular action of the intestines seems to continue, as shown by their being so ready to expel their contents in the morning, while the kidneys are hard at work all night.

In the accompanying diagram an attempt is made to show all this more clearly. Let A stand in α for the organs con-

FIG. 7.
Morning Flow from Seats of Assimilation.
Midnight Flow to Seats of Assimilation.



cerned in the process of assimilation, the dotted line being supposed to show the minimum of vital power in the seats of its action at eight in the morning, at which hour it is assumed the full stream has set in towards the animal life B, the brain C, and the organs of digestion D. Then in β we have the very reverse. The hour chosen is midnight, though any time between ten P.M. and four A.M. would do equally well, and according to the hypothesis the current is supposed to be flowing from these systems, but especially from the two first, the brain B, and animal life C, towards the seat of assimilation A; the dotted lines at B and C showing the minimum of power present in these parts.

I look upon it as certain then that there is less power in these three groups at twelve o'clock at night than there was at eight in the morning, and now the next question which comes before us is why this happens. It has been stated in the most unequivocal manner, that the cause is exhaustion of the muscular, nerve, or vital force in these parts, so that a period of rest has become necessary for the generation of a fresh supply. I never could exactly make out whether the orthodox creed is that two or three forms of energy are worn out at the close of each day, or only one; but that there is exhaustion, and that rest is required to

generate a new store, I never yet heard doubted. Indeed the condition of man at this period has been compared to that of a galvanic battery which has ceased to work, and requires a fresh supply of acid and sulphate of copper, with a certain amount of time, to renew the needful force. The explanation is improbable, inadequate and illogical.

It is improbable because force is in some cases restored without food being taken, as in the case of starving men when refreshed by sleep, and in that of persons undergoing great fatigue being revived by rest and food before the food can possibly be converted into force, as when a man pauses for half an hour in the course of a long severe walk to take a bath and a hasty meal; because there is no evidence of force being stored up during long periods of entire rest when food is taken; because two of these systems, the cerebral and animal, can on emergency be roused to a very active state even directly after sleep has begun, which could by no possibility be the case were there exhaustion of the force requisite for their actions. It is inadequate because, while professing to elucidate some point it really leaves matters where they were. And above all it is illogical, because it begins with supposing the necessity for an action which would be superfluous if it could be proved; seeing it is quite clear that there must already be a pre-existing force in the body to convert the food into force, for what other agency is there in the human frame which could effect this except heat and moisture, and that they are themselves inadequate is evident, or the chemist could elaborate chyme and chyle, blood and bone, which we know he cannot do.

In plain words I consider the whole creed bad and the comparison with a galvanic battery worse: it means simply clothing a vague belief in language which is termed scientific but ought to be called mystical. It is one of those fanciful things with a core of error and not a very good imitation of truth for a husk, which spring up like toadstools and are of about as much use to humanity. It starts with a confusion of ideas, for it would be quite as rational to say, that darkness is due to exhaustion of the light of the sun, and that in darkness we must remain till a new supply was generated. A battery, once exhausted, cannot be roused on the spur of the moment, as the brain and muscles can; there must be time at least for the acid to work upon the zinc and the cupric sulphate on the copper. Once set going its action can by proper management be kept up for any conceivable time; but no amount of supply, no device known to the physiologist, will enable the human frame to go beyond a certain period, looking very much as if the structures, which could alone utilize fresh stores of food, were for the time being deprived of the power to do so.

Night the Time for Death also.—The more facts are looked into, the more I contend will they show that the vital power is withdrawn from these classes of structures during sleep. Thus there is evidence that the close of what may be considered the middle period of man's natural term for sleep, or about four to five A.M., is the most fatal of all to life; so much so that, according to Professor Laycock, the chances are three to two that the last sleep will occur at that time, or when the barometer, electric

tension, temperature and consumption of oxygen are at their lowest. Were due allowance made for deaths by violence, and rapidly mortal diseases such as asiatic cholera, where the fatal event stands in such close relation to the time of exposure, there would perhaps be a still higher proportionate quotation of deaths at the morning hour; the explanation of which fact in itself I suppose to be, that a certain amount of vital power being withdrawn from the organic life to the arena of disease, the maximum derivation during sleep to the seats of assimilation causes the termination of life, by over-draining the vital organs, particularly the heart.

Explanations of Sleep.—Sir Henry Holland says sleep is the great mystery of life, and so far as any physiological explanation, or any metaphysical description, of it is concerned it is certainly likely to remain a mystery. Take for instance the account given by the illustrious Locke. Speaking of sleep he says, "In this retirement of the mind from the senses it often retains a yet more loose and incoherent manner of thinking, which we call dreaming, and last of all sound sleep closes the scene quite, and puts an end to all appearances." Unless mere corporeal feelings are meant here, there is an error to start with, for the mind is the same thing as the senses as he uses the word, and it is not the rule that dreams, when they occur at all, precede deep steady sleep, nor is there a uniform gradation through them to this state. On the contrary they frequently follow or interrupt sound slumber, and it is not unusual for persons, who are very tired, to fall asleep without any intermediate process and yet to be wakeful and dreamy in the morning.

Man, too, does not think in a dream any more than in the delirium of fever.

The phrase "retirement from the senses" is peculiarly misleading. If you will be content to regard an operation of the mind as an exertion of the vital power through the medium of the brain, just as lifting a weight is an exertion of it through the muscles, and for Locke's term to substitute retirement of the vital power from the brain and animal life occasioned by the demands of assimilation, you will see in this act what I cannot help thinking is a very simple explanation of sleep. Indeed I submit that the hypothesis of the vital power rolling daily through its cycle of actions, animating first and at the time when they can be most fitly employed, those organs which connect man with the external world, and enable him to seize his food and then to eat and digest it; and when this task is accomplished, ebbing towards the parts which are to assimilate the food accumulated and digested during the day, affords the only feasible explanation of alternate sleep and wakefulness which I have yet met with; while it is not only consistent and harmonious in itself and in all its parts, but is also quite in unison with that strict economy of force which Nature so constantly displays.

Looked at from this point of view it is easy to understand why assimilation, which demands so large a supply of vital power, should take place contemporaneously with repose of those organs most calculated to disturb its due performance. It seems to have been Nature's decision from the hour of his appearance on earth, that man, looked *at here as representing the great aggregate of mankind,*

should not have the power to interfere with the continuance of his existence and race, and that this iron law should be impressed with the greatest energy upon the parts most required for life ; that at the very outset, obeying the impulse it receives when existence begins, the vital power should construct the most indispensable of organs to life, that which supplies all material for assimilation, of such a sensitive quality that man cannot long forbear attending to its wants. It seems to me that it is only this provision which prevents the more timid animals, and even the greater part of mankind, especially in the civilized state, from perishing of hunger ; for, when we see how people neglect the rules of sense and the encroachments of disease, we may feel sure that avarice and laziness, stupidity and irresolution would make numbers neglect food if not sharply warned.

Necessity for Sleep.—It will be said that there are numerous instances on record where both men and women have done without sleep for long periods, and others where they have lived for many years with less than half the ordinary amount. There is some truth and a good deal of exaggeration in the statement, men not stopping to remember that many tales are told about many subjects, which never take place for the simple reason that they could not have happened. About eight or nine days is probably the extreme limit of time that the human frame can go without sleep, and violent hallucinations have been known to follow a shorter period of privation ; even Newton's powerful and well balanced mind was seriously affected by a five nights want of sleep.

As to the power of doing with a less amount of sleep than natural, there seems little doubt that such a state ~~would~~

endure weeks and even months; how long has I believe never been ascertained. Fifteen months is the longest period known to myself. That such a condition, looked at as the invariable rule of life, ever co-existed with a sound state of the brain, that any healthy man ever passed years with his allowance curtailed, may be doubted till better proof is adduced. Such evidence as we have is generally uncorroborated or overdone. Napoleon has been cited as an instance of the power of doing with very little sleep; but Bourrienne, his schoolfellow and private secretary, who for many years was constantly with him except when in the field, and perhaps knew more about his habits than any other man, flatly contradicts the story. He says the first consul liked to get to bed at twelve, that he slept well, and when roused at seven often begged for leave to sleep till eight and took advantage of the permission. A similar story is told about Lord Heathfield, famous as General Eliot, but not an iota of evidence was ever brought forward in support of the assertion. Sir William Lawrence, in his Hunterian oration delivered in 1846, says that John Hunter habitually worked nearly twenty hours out of the twenty-four. But this would leave no time at all for sleep; eating and drinking; dressing and undressing; the unavoidable calls and minutiae of life, would of themselves have absorbed the remainder. Even Julius the Second, who could not spare time enough to have his beard trimmed, and Ney, who never had time to feel afraid, could not have done on a shorter allowance for these details than three or four hours. I therefore beg most respectfully to record as my opinion that what Lawrence states never occurred, and that the fact

of such an assertion being made by such a man, and never yet refuted, is strange evidence of the credulity which prevails among the educated. One might think that the lesson of their lives would teach medical men a little scepticism, yet here we have a whole assembly gulping down a tale which really required the appetite and digestion of a credulous schoolboy.

In conclusion then, what little I have been able to make out goes to prove that men of genius, men who tax their brains, want quite as much sleep as other persons and take it; and I cannot help suspecting that a belief to the contrary owes its existence, not to anything in the shape of fact or probability, but to a passion for the marvellous, for garnering up and telling again as though it were gospel, any tale calculated to gild the lecture and strike the imagination.

Fitful Returns of the vital Power.—It will sometimes happen that a part, unduly worked by day, manifests a certain amount of vitality by night when it should be at rest, or gives indication that the vital power is ebbing more slowly than natural from the overtaxed organs. Thus for instance as regards the structures of animal life, people often say they are too weary to sleep; or again the muscles of the sleeper will suddenly contract, perhaps with force enough to shake the whole frame and break the deepest slumber. Itching of the skin often occurs when this organ is in a morbid state, as in the case of a person suffering from eczema. This last is, I may say, one of the facts which favour the supposition that the attraction of the vital power to an unhealthy part may be quite independent of the cir-

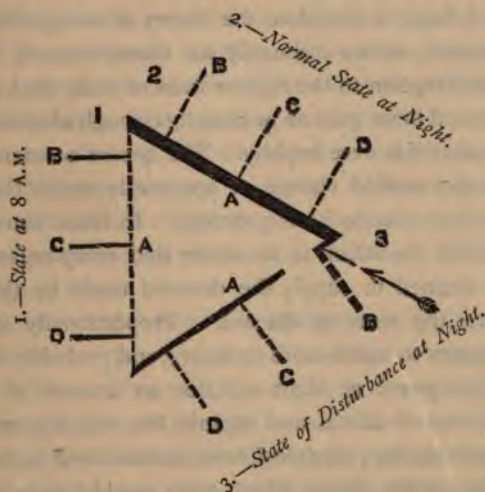
culation and secretion ; for while the discharge of eczema usually lessens during the night, the itching may be so aggravated in sleep that the patient tears the skin with his nails. Nor is this due merely to the heat of the bed, for I have known patients sleep very cool in order to keep off the irritation and yet scratch themselves every night during sleep, while the heat of a fire or a vapour bath will often relieve the excited state of the skin.

Again a man, who has overloaded his stomach in the evening, will often be partially conscious during sleep of an uneasy sensation there. But I think it is in the disturbed movements of an overtaxed brain that we see this kind of action chiefly displayed, both in respect to its commonness and its visible reflection upon the structures of animal life. Thus I have known a man, made very anxious by business, wake in the night with a yell almost like that of an epileptic patient. One gentleman used two or three times a week to spring up, out of what looked like sound sleep, with such suddenness and violence that it seemed strange he did not hurt himself ; and a teacher of anatomy told me, that whenever he studied very hard he was plagued at night with spasmodic movements which made him "jump like a frog." I could easily quote more instances, but I think these are enough to point to its being the rule of vital actions, that *the more persistently and strongly the power is attracted to any part during the day, the more marked is the disposition in it to return at night to the seat of over action*, though circumstances, as yet unexplained, may determine it towards other groups of structures. I will try to explain this by a diagram.

Let A at 1 represent the supposed amount of vital power at the seats of assimilation at eight A.M., and B C D the amount in the organs of animal life, the brain and organic

FIG. 8.

Return of vital Power to Structures of animal Life during Sleep.



life; then at 2, which is intended to denote the normal state at night, we have A receiving the maximum supply, while B C D, standing for the same groups of structures as at 1, are very scantily supplied, as shown by the dotted lines. At 3 this is so far reversed that the B, or animal life, current is increased, an effect supposed to be displayed by an enlargement in the size of the dots, while the assimilation current is broken, to show the influence exerted on

it by the disturbance. The diagram refers solely to the animal life, but those who can follow me thus far will readily supply what is wanting.

The misery caused by hallucinations subsides during sleep, while the delirium created by fever increases, and I especially touch upon this apparent contradiction now because it helps to elucidate the theory of antagonism. In hallucinations, as we ordinarily see them, there is no particular interruption to the regular train of daily vital actions. The diseased brain goes as punctually through what work it is capable of as if it were healthy. The system accommodates itself to the morbid change at apparently much the same pace as that change itself proceeds. In fever there is no time for this, the attack is so severe that every organ seems at once drained to supply the demand made by the parts which are the seats of disease. Proportionally too, the brain appears to suffer more in fever; and probably the ebb of the vital power at night sets free an amount of it from the structures of animal and organic life, which is attracted to the brain on the principle I have endeavoured to describe, in speaking of the affinity which every morbid agent appears to have for this force, a part of the subject however which can be better considered when treating of disease.

C. *The Phenomena of Disease.*—In examining this state the first great obstacle which we encounter is the impossibility of laying out the matter, to be investigated in such a way as will give general satisfaction. If therefore what I have to say should appear to be set forth in a discursive and unsystematic manner, I must ask your forbearance on the old ground, that there is no precedent to go by. And un-

systematic and incomplete too it will be, for with such a wide field before us as is offered by a general survey of morbid actions, the aim must be rather to indicate the views submitted to you by a few striking illustrations than to attempt the construction of a complete system ; an endeavour will be made at the same time to give these views such a shape as will admit of their soundness being tested at any stage of the argument. If they will not bear this trial they are not worth farther trouble ; if there be but one flaw in the chain of reasoning its doom is as certain as if it were faulty throughout. But should dispassionate examination show that they will stand the test, that there is no material error in the conclusions drawn, then their application may extend by its own natural force till it overspreads the whole field of pathology.

Definition of Disorder and Disease.—Perhaps the way most conducive to clearness and precision in which I can put what I have to say, will be to start by describing as well as I can what disease may be considered to be. I would therefore define both it and disorder as intensified performance of one or more parts of some function or functions, accompanied in the case of disease by change of structure, the vital power being attracted to the disordered or diseased part with a force proportioned to the magnitude and force of the morbid agency and the extent over which it ranges, and ending in two ways ; recovery in which the vital power is gradually withdrawn from the diseased or disordered structures, and death in which the vital power is so strongly attracted to the seat of disease as to overdrain the structures of organic life. I hope to show that whatever other morbid

action takes place in the human frame is accessory and subservient to this.

The view that disease consists in an exaggeration of some part of a function may be thought merely a repetition of Hunter's opinion, who considered inflammation "as an increased action of that power which a part is naturally in possession of;" but a little reflection will show that the two processes are widely different, and that the action of disease, as I have defined it, always interferes more or less materially with the proper and natural action of the part, which I suppose is what Hunter is speaking of. I therefore consider the distinction absolute, and perhaps it may save time if I say at once that, right or wrong, the vital theory power stands on its own basis, and that it is as independent of the increased action suggested by Hunter, as it is of the vital energy of Cullen or the *sthenia* of Brown. Consequently I propose to leave all such questions on one side, and, starting from the definition just given, to take one or two instances of those diseases which are met with every day, and see firstly if the vital power theory will explain them; secondly whether there is any thing in diseased actions which militates against the doctrine; thirdly whether the progress towards recovery will bear the same explanation, and lastly if the action of remedies will support the theory or not.

1. *Will the theory explain certain common Affections?*
I. *Scarlatina as an Illustration.*—I will begin with this affection and see first of all, whether its course will illustrate the theorem that disease means increase of some parts of one or more functions, with corresponding decrease in others. Before scarlatina attacks our imaginary patient, say a lad

twelve years old, his spirits and appetite are good, his pulse natural, perhaps seventy five to eighty, the temperature normal or about 98° , brain clear, capacity for exercise great, excretions from skin, bowels and kidneys regular. But two or three days after the attack has set in the temperature has risen quite five or six degrees, the pulse is half as high again as in health, the transpiration is so rapid that even with a dry skin the patient loses weight faster, I believe, than he ever does when all the secretions are going on. In the mean time the spirits, appetite and capacity for digesting food and taking exercise have fallen almost to zero; the brain is confused and weak; and the excretions from the skin, kidneys and bowels are greatly lessened.

What then is the meaning of all these important changes, except that these portions of the compound mechanism of life, the generation of heat, the circulation of the blood and the transpiration, have undergone alterations which throw upon them a great increase of labour; while on the other hand certain functions, such as those of the bowels, kidneys and stomach, are almost suspended; and that this torpid state is shared by the structures of animal life as shown by the indisposition to exertion, and by the brain as manifested by the incapacity for thought? How is this increased action to be got through except by means of a greater amount of power at the seats of it, be the source whence this power comes what it may; and does not the lessened activity of the brain and muscles show that the supply of power to them is lessened for the time? If then we suppose that in the genesis of a scarlatina, an air charged with some noxious ingredient, such as a peculiar state of the atmosphere or

emanations from a person with this disease, comes in contact with some part of the frame, possibly the mucous membrane of the fauces, windpipe or lungs, and that this air possesses the property of stimulating in a particular way the transpiration, circulation and generation of heat, just as croton oil or jalap will, each in its particular fashion, stimulate the action of the intestinal tube, or tickling the fauces will excite the muscles which act in retching, then I think a definite form is given to the theory.

Most persons are however convinced that the changes in the system just described are due to the introduction of a poison into the blood; and that the eruption of scarlatina is direct incontrovertible proof that this poison is being eliminated. Nature's own handwriting, they hold, attests the truth of this great offshoot from the humoral theory, the rash being clearly an effort to free the system from a mischievous intruder; the tumult in the frame is merely occasioned by the struggles to which she rouses it for this purpose; the torpor by the circulation of the poisoned blood through the economy. I need not name the many able men who have supported this view with so much learning and talent, nor inflict upon you the opinions of the many infallible persons who support it without either the one or the other. You can do that for yourselves. You have only to fall back upon memory, and they will start from their hiding places as thick as the warriors at the signal of Rhoderick Dhu. But though numbers are against me, I must urge that the theory of blood-poisoning is unfounded, and the reasoning by which it is explained and illustrated, *if indeed we can use such terms at all, is illogical and unsupported by proofs.*

The whole creed is a lamentable instance of the facility with which doctrines, if only proclaimed loudly enough, are caught up. At least twenty two diseases are unhesitatingly ascribed to a blood-poison, a noxious ingredient either introduced into or generated in the blood, gout being invested with two, as an acknowledgment I suppose of the priceless services it has rendered to humoralism ; and almost without exception the belief that such is the case is treated, not only as positively established, but as if the request for anything like proof could only arise from a sheer desire for opposition. I should really have thought that maintaining such a creed meant taking great pains to get into a dilemma, for if it were demonstrated, it would not help us a step on the road, and it stands little chance of being demonstrated, for such contradictory properties as inducing torpor and arousing a struggle in the frame, not being met with in other bodies, cannot reasonably be looked for here. Consequently, I believe we shall have to wait a long time before we see the doctrine proved. No doubt it derives a certain degree of factitious stability from being so closely interwoven with many questions of practice. Pathology and treatment, both founded on the hypothesis of a blood-poison, seem to be alike standing on a secure basis, but there is a wide distinction between the two conditions. The positive facts bearing upon treatment must be admitted ; the evidence in support of the theory amounts to no more than mere conviction, to a rooted belief from which every thing observed about the disease borrows its current hue and form. The creed lives upon sufferance ; it literally exists only in the region of possibilities, and very remote ones too. You may

perhaps think that this means putting the case too forcibly ; the excuse is that I know of no other method likely to be successful. A favourite theory is not so easily got rid of, and there are cases where too much reticence is as great a mistake as too little of it would be on ordinary occasions. "An hypothesis," says Brodie, "which has once been admitted, and to which men's minds have become habituated, will still continue to be taken for granted, long after the slender foundation on which it originally rested has melted away from under it." How much more likely then is the doctrine we have been speaking of to be taken for granted, when the foundation on which it stands is still considered as impregnable as truth itself.

How does the Poison get into the Blood?—In examining how the prevailing doctrine can be applied to scarlatina, this is naturally the first question in point of order, though as regards its importance it can scarcely be said to possess a place at all, seeing that it is never either asked or answered. I should have thought it one of the most subtle of the problems with which medicine has to deal, one requiring devoted and ceaseless observation, and only to be solved by rigorous sifting and weighing of facts. Not at all. Any such painstaking would be pure waste of time, and for this excellent reason its solution has, as concerns scarlatina, never been attempted. I certainly once heard an eminent fellow of the Medical Society of London maintain, at a meeting of that body, in a discussion on a paper by Dr. Snow, that the poison of another disease, cholera, gets into the blood by the orifices of the mucous follicles in the *mouth* and stomach ; and though he did not offer a vestige

of proof, or even say that he had investigated the subject, yet no one seemed to consider that this statement, which would not have been suffered to pass current where strict research was pursued, for instance in a discussion on an astronomical question, called for remark. But as regards any other disease, my attempts to discover an explanation or even a conjecture have been utterly fruitless. Perhaps however the most extraordinary feature in the case is that those, who talk of a virus being the cause of the disease they are speaking of, seem scarcely ever to have formed in their own minds a clear conception of what shape the poison wears when it enters the blood.

What becomes of it after it has entered the Blood?—To this there can be of course but one answer. It multiplies, taints the blood, and is finally expelled by the medium of the eruption. I will take the first step, the multiplication, and ask whether it is satisfactory that this process, which is so confidently spoken of, and which indeed forms the basis of the nomenclature and classification of the exanthemata, should nowhere be defined? Some vague idea seems to prevail to the effect that it, an animal substance, by a violation of natural laws, multiplies in the blood of the infected person, just as some low forms of vegetable life do. Such at any rate is the only interpretation which, so far as I see, can be put upon the term selected by the Registrar General, for what can a zymotic process mean, when reduced to plain english, but a ferment? I will not stop now to inquire how scientific botanists would receive such an explanation of the mode of genesis and reproduction in a plant; I proceed to point out that for fermentation to be

produced, it is absolutely necessary that air should have free access to the fluid acted upon, and that the fluid itself should be at rest, while the nature of the process is, when once set going to convert the entire mass of the fluid into a fermented liquor, a result accompanied by the formation of yeast and carbonic acid which would totally unfit the blood for circulation. As the only means which could arrest such a process, could by no possibility be applied to the human frame, it follows that every person in whom a true zymotic process was set up would infallibly perish. It may be urged that we must put up with a little want of precision, that we cannot observe the changes in the circulating fluid so accurately as we can the processes of the vegetable kingdom, but then what cannot be clearly made out should not be taken for granted; the more valid the excuse the greater must be the defect of a system which needs it. Such utter looseness as we find here about the shape and nature of the poison of scarlatina, the way in which it enters the blood, and its maturation when there, ought to wreck any system; and I must contend that it would be far better to admit our entire ignorance than to make use of a theory, which, however convenient as a shield, however serviceable as an excuse for the assumption of a knowledge which does not exist, is, strictly looked at, simply a fountain-head from which issues an ever-growing stream of error.

Physiologists, it will be said, accept the prevailing doctrine. One gentleman lately extolled the prophetic spirit in which our worthy Registrar General, to whom be all honour and length of days, had selected the term zymotic. The experiments of Pasteur, Burdon Sanderson and others had

amply justified his view of the subject. The old doctrine of a ferment, exploded upwards of half a century ago, and revived in more than pristine force by Liebig, is to flourish again, and put an end to all difficulties, though I should myself have said that their observations not only did not explain the multiplication of a virus in the system, but did not cast even a ray of light upon the scene.

To assail a doctrine which is generally accepted is never a hopeful and generally a useless task. One might think that the mere fact of a doctrine being adopted without investigation, of its wanting every essential of stability, of its having in its favour neither foundation, proof nor probability, would sometimes lead men to reflect upon the precarious nature of its existence, and to ask themselves whether it was quite right, that a pathological system should depend for the breath of life upon the continuance of a thing scarcely more vital than a phantom, as vague and unsubstantial as the formless shades which Fingal beheld issuing from the halls of Cruth-Loda; whether too the whole creed might not beneficially be inquired into,—so that if found trustworthy, it could forthwith be endowed with definite shape and substance, and if discovered to be a gigantic imposture, it could be offered up as a sacrifice to outraged reason. It may be that some men really do think in this way; all I can say is that I have come upon no trace of such opinions, and can therefore only assume that such defects, as I have mentioned, do not impair the popularity of a theory which offers a convenient refuge for our vanity, and spares us the humiliating confession of ignorance. Any arguing against such a valuable doctrine is simply special

pleading to which we have never paid, and do not mean to pay, any attention, the latter decision being excused by the former practice, and both justified on the ground, that what has not been objected to by authorities ought not to be objected to at all. Besides, novelty may not be right and is sure to be inconvenient; the very fact of the old doctrine being wrong is one of the best reasons why the other may be so, which after all could teach us nothing that we really require to know. But indeed it is conceding too much to admit that we can by any possibility have erred in cleaving to the old creed. Disease can be explained in this way and no other. Consequently, having reached the goal, having got to the very *penetralia* of Nature's secrets, we cannot have taken a wrong road and therefore do not care to hear of such a contingency.

You may think this a caricature of physiological belief; I tell you it is practically the way in which men reason about the matter when they stop to reason at all. Still, in self defence, they might well pause and ask themselves the questions I have just shaped out, and particularly, though of course I suggest it with all due respect, whether they have, as a preliminary step, reduced their own ideas to a definite form. In a discussion on this subject at the Medical Society of London, the late Dr. Edward Smith said that after all the dispute was only one about terms; those who ascribed disease to blood-poisoning, and those who would explain it by action of the solids, meaning really the same thing only in different words. Such an opinion could only have been stated by a person who had not even cursorily examined the question, and could have been

accepted only by hearers who were very easily satisfied, seeing that the point at issue involves the very foundations of zymotic pathology.

Defective Evidence of the Presence of a Poison in the Blood.

—Quite irrespective of the question of its multiplying in the circulating fluid, I do not feel perfectly satisfied that there exists, in the whole range of zymotic pathology, a single unequivocal piece of evidence showing that there is ever a poison in the blood at all. We know it is constantly and positively stated that scarlatina depends upon the presence of a virus in this fluid, the response of "what else can it be?" being evidently considered enough to dispose of any objections. I will leave to those who base pathology on positive statements all the advantage they can possibly derive from the practice, while I proceed to examine the facts of the case.

Considering that there are at least three and twenty blood-poisons, it seems mysterious that they should all be invisible to the most powerful microscope, a fact unrecorded of any form of life; that the most persevering search should never reveal any definite pathological change produced in the circulation by a single one out of all the number. I ask you to say, whether you know of any branch of scientific investigation which would require us, as a preliminary step, to suppose the existence of twenty three bodies, possessing powers of concealment for the parallel of which the organic kingdom would be ransacked in vain. It may be pleaded that the effects of their inoculation, the specific diseases themselves, prove that these substances exist in the blood, but it would be more logical to say they prove that certain

persons have agreed to think so. Indeed perhaps the proper plan would be to leave to its natural fate a theory which needs such arguments for its support, but in these lectures I cannot afford to pass by a creed so widely spread and so deeply cherished; it is here an obstacle to overcome or to be overcome by.

Scarlatina is spoken of as a specific disease, and men have accustomed themselves to look upon it for this among other reasons as definitely allied to measles; they stand side by side in nosology, and are with equal want of hesitation ascribed to a blood-poison. Yet one great test on which the specific nature of disease is based, inoculation, is said to have failed in scarlatina and succeeded in measles, looking very much as if the blood had nothing to do with the matter. But even had the inoculability of scarlatina been demonstrated, it would not have proved that there was an actual existing poison in the blood. It might have shown that this fluid had acquired the property of communicating the disease, but beyond that the power of the evidence which it yields would not go. Equally it would not have proved that there is any connexion between an inoculable state of the blood and the disease, for it is certain that the latter will continue after this state of the circulating fluid has passed off, and that the contagious qualities of disease exist in a state of matter which could not circulate. Farther, I apprehend that the question of the specific nature of a disease having anything to do with its origin from a blood-poison, must be given up; generally because there is reason to think that the line of separation, held to be established *between* specific and common diseases, has to some extent

been abandoned, and particularly because there are actions, analogous to those seen in the exanthems, which are clearly due to non-specific causes.

Actions like the specific produced without the Agency of a Blood-Poison.—It may be assumed that every typical symptom seen, not only in scarlatina, but in the whole series of diseases ascribed by common consent to the introduction of a blood-poison into the system, may be observed in other morbid states, where so far such an agency has not been dreamed of. I do not say that the same group of results, or that any one of them in the same degree of intensity, may be produced by the one as by the other, because various observations have led me to think that *any agent, capable of generating disorder or disease, acts differently from every other agent*; what I maintain is that the symptoms, taken separately, may be found in common diseases. It is in the grouping, the different relative intensity of the actions set up in various parts, and the morbid changes resulting therefrom, that we really see the distinction. There is in the specific disease *no absolutely new action*, as we might expect to be the case from the introduction of *a new element* into the system; everything, even to the eruption, resolves itself into intensity of natural function, plus the contagious quality acquired in the desquamative stage. The rash of scarlatina is not more specific than that set up by rubbing croton oil or cantharides upon the skin; the operation of heat or electricity upon the human body is as certain in its way as that of specific disease on the throat. But the fact is we so accustom ourselves to speak in this way, that we do not notice the contradiction involved by the use of the

term, or rather by its restriction. We talk of the system being affected by the specific action of mercury, and that too, not merely, it is to be remembered, as opposed to its purgative properties; whereas I suppose it would be considered out of order to speak of the specific action of antimony, arsenic or barium.

We may not find any agency, except one itself classed among blood-poisons, which induces such antagonistic effects as excessive transpiration and diminished sweating, both pushed to the extent we see in scarlatina; but we meet with this conflicting state in eczema, and we may see it in ichthyotic patients suffering from feverish cold. I need scarcely say that vivid redness may be occasioned by many irritants, and that increased heat of the skin may be seen in simple pyrexia. The appetite may be completely suspended, digestion arrested and the tongue parched by mental anxiety. Quick pulse arises from too many causes to make it necessary that they should be pointed out. Similarly, lessening and even suspension of certain functions ensue, sometimes in a very marked form, from other causes such as grief, fright and revolting impressions.

Tinea, in Reference to specific Action.—If we take the feature so much relied on as indicating a specific nature, the reproduction of a like disease in another person from the secretions of a patient labouring under a particular illness, we find that maladies as distinct as the exanthemata, for instance tinea, run their course and are re-produced without the agency of a blood-poison. It may be said that the vegetable growth is here the agent of transmission, and that the comparison does not hold good; but it is to be

remembered that the question turns, not upon the presence of the parasite but the absence of the virus. The parallel, again, between a disease so slight as ringworm and one so serious as scarlet fever, between one which sets up little if any visible disturbance of the system and another which often ends fatally, may appear far-fetched; but the difference is more apparent than fundamental, it is a question of suddenness and extent rather than of quality. Ringworm possesses one great feature of the exanthemata in quite as marked a degree as scarlatina itself, for according to my experience it never occurs twice in the same individual. Extension over a large surface is perhaps the most important of all features in estimating the gravity of such diseases. Thus if ringworm were as sudden and widespread in its attack as scarlatina, we might find its visible constitutional operation very different. A scald the size of a tinea patch would scarcely produce an appreciable effect upon the system; one ranging over as much of the skin as is affected in severe scarlatina would be fatal. It may therefore turn out that the gravity of the symptoms in the exanthem means, not so much specific nature as extent of surface affected and rapidity of course.

II. *Smallpox as an Illustration.*—I suppose this affection may be looked upon as one of the strongholds of the zymotic doctrine and consequently of blood-poisoning; yet the argument that the chain of symptoms seen in it can, or rather must, be explained by such a hypothesis, however specious at first sight, turns out when analyzed to be faulty at the very core. I pass by the arguments already used about the possibility of all its symptoms being seen separately

under other shapes in other affections, in order to contrast it with another disease, herpes zoster. Here we have, as in variola, a definite, specific and protective disease running on a smaller scale the same course as regards the skin symptoms. We have in both cases the vesicle forming on the papule and becoming more or less purulent, all without a blood-poison. It may be urged that there is still a world-wide distinction, that smallpox is contagious, can even be inoculated from, which is not at all the case with herpes, but then these qualities are found in the tineæ if not also in molluscum, which means that the two distinctive marks of specific nature, not being peculiar to blood diseases, are of no real value.

III. *Eczema as an Illustration.*—To make the parallel still clearer I will take a case which occurs often enough at certain seasons of the year. A patient, with a predisposition to eczema, is exposed for some time to a biting east wind, and returning home chilled and tired sits down by the fire-side. A very probable result will be redness of some part more than usually liable to be affected by these changes of temperature, and at the same time prone to take on the eczematous disposition, as for instance the lower and front parts of the legs or the outer sides of the arms. In course of time this redness may become as vivid as that of scarlatina, be accompanied by burning heat, and be followed by diseased secretion from this part of the skin in the shape of imperfectly formed cuticle, discharge of serum, crusts and pustules. Yet all this, as peculiar to eczema as the umbilicated pustule is to smallpox, goes on without the intervention of a virus, or a zymotic process for multiplying this virus in *the system*.

You may think that likening the action of a cold wind upon the skin to anything seen in an exanthem is going beyond all bounds, straining comparison too far in fact, but I submit that there is a close analogy between the process just described and the way in which the zymotic disease is caught. A child enters the room where a patient is lying ill of smallpox, and without touching the patient, contracts the disease; that is to say a part of the surface or mucous membrane is exposed to air charged with the poison of smallpox instead of the poison of the east wind. In each case the hostile agent sets up a train of symptoms peculiar to itself; or in other words, if the theory which I have the honour to lay before you be correct, each attracts the vital power in a particular way to the seat of impact. Probably in the exanthemata this is the mucous membrane of the fauces. It is not protected by clothing; it stands in some measure exposed; the inspired air must pass over it, and it is acted on injuriously by agencies in the air which produce little if any effect upon the skin. But there our knowledge stops. The pathology which describes the absorption of the poison extracted from the air, and its growth up to the time of its final elimination, which accounts for its movements by a combination of what is seen in botany, engineering and physiology, till the multiplied virus takes on the triple character of a mass of seeds, a fluid and a nonentity; a thing as invisible as a gas and yet as incompressible as water; a nondescript which can be likened to nothing on earth but itself, is purely imaginary. As cloud lies piled upon cloud, the bearer and its burden equally shadowy and unsubstantial, so does this hazy part of zymotic pathology stand on a

foundation which, when looked into, proves but a mist of words.

IV. *Erysipelas as an Illustration.*—Let me ask you to take a case of this affection, and say if it does not show that disease and disorder mean intensified function, and that neither specific character nor severity of type can be viewed as signs of a poison in the blood. I select this disease because it has been so unhesitatingly ascribed to a blood-poison, because every symptom of it can be traced separately or conjointly to other pathological states, and lastly because its course illustrates the limitation of the vital power. In the mass its symptoms are peculiar to itself; dissected out they may be seen as the result of burns, scalds, shocks and other noxious agencies. In proportion as the redness of the skin, burning and secretion of serum increase, do the weakness of the muscular system, confusion of thought and lessened power of digestion testify to the growing drain of the vital power to the seats of disease; and I cannot understand to what such symptoms point unless it be translation of vital power; depressed action in the animal life, brain and organic life, and hyper-action in the affected part.

I stated in the earlier part of these lectures, the intention to bring forward instances of disease unhesitatingly ascribed to a poison in the blood, and where yet a virus could not possibly have played the part assigned to it, and I select hydrophobia. It will be superfluous to name even one of the many eminent men who have spoken of the absorption into the system of the virus which induces this dreadful illness, for the fact of such being its pathology is familiar to all. But it can only be taken up into the system by the

veins and lymphatics, and the latter pour their contents into the former, so that practically absorption means the virus reaching the blood, where, according to received opinion, it sets up effects so utterly opposed to all reason that I never could understand how people believed them. For we are told by men whose veracity is beyond challenge, men like Druitt, Watson and others, that a period of more than a year and a half has been known to elapse between the bite and the outbreak of the disease, that a man has died of hydrophobia in prison years after he could have been in contact with a dog. We ought certainly to have some explanation of such a pathological mystery as that of a virus multiplying all this time in the blood without revealing itself by a single sign; a mystery of which the vital power theory at once gets rid.

To escape from this dilemma, Sir Thomas Watson supposes that there may have been a second infection without the patient being aware of it, but with all proper deference to the distinguished author of this suggestion, I must say that I think the fact of being bitten by a mad dog is an event not at all likely to be overlooked; perhaps I might go farther and add, that zymotic pathology must be in a sorry plight, or rather driven to its last shifts, when it makes use of such an argument. Worse still, Sir Thomas himself tells us that a man died of hydrophobia although his hand had only been grazed by the tooth of the dog, *there being simply an indentation of the surface*. But there is still a lower depth. A few years ago an inquest was held upon a man who had died of hydrophobia, when the dog, the bite of which had occasioned the disease, was produced in court alive and

well. With such facts staring us in the face, with the knowledge that tetanus, a disease closely allied to hydrophobia, constantly arises from injuries of a somewhat similar nature, when there is not the least suspicion of a blood-poison, and that a distinct morbid state is in traumatic lupus called into play by lesions still closer allied, that is to say by bites, I think we may, as concerns this part of the subject, leave the humoral theory to expire of itself. I see every reason to believe that the bite in hydrophobia and the injury in tetanus act exactly in the same way as I have assumed every noxious agent to do, that is to say attract the vital power in a particular and specific way to the seat of impact, from which results a particular class of symptoms, and these in their course illustrate the limitation of the vital power just as those of scarlatina do, that is to say judging as well as I can from my own reading, for I have not seen much of lock-jaw or hydrophobia. Taking this then as a guide, I feel justified in considering it as certain that, in those affections, as the spasm gains ground the pulse becomes more feeble and the power of thought declines, till in fatal cases all such manifestations cease, while in more favourable instances, such as those of recovery from tetanus, command of thought and strength of pulse return with the decrease of action at the seat of disease.

V. *Common Inflammation as an Illustration.*—But perhaps no affection more clearly exemplifies the postulate, that disease means intensified partial function, than this disorder itself. The symptoms are well known, and we find them now just as they were described by Celsus ; heat, pain, redness and swelling. That heat is an augmentation of a

natural state I need scarcely say ; its steady increase in so many inflammations, without our being able to find out that anything has been added or taken from the body, without our being able to determine when the increment of temperature began, suffices in my judgment to show this. Similarly, that pain, commencing with a sense of stiffness and distension, is an increase of the natural sensibility, is, I submit, made evident by the unusual tenderness felt even before swelling comes on ; the patient indeed is so conscious of this heightened tactile sensibility, that he instinctively takes every care to guard against a blow. We may deal with the redness as with the heat ; it can be traced from the normal pinkish hue of the skin through every shade up to the greatest lividity. The swelling is more new than anything else, but only so in appearance, for I need scarcely tell you that it is due to an increase in the natural amount of serum. All this has been said before and said much better, and indeed it is no part of my task to describe morbid processes ; my object is to point out that here, without any blood-poison, we have, from the redness of the papule to the formation of matter, the analogue of every symptom attributed to a virus.



LECTURE III.

How is the Poison got rid of? 2. Is there anything in disordered Actions which militates against the Theory? 3. Will the Progress towards Recovery bear the same Explanation? I. Recovery from Scarlatina as an Illustration; these Changes usually attributed to Elimination; Depression of vital Powers considered. II. Recovery from Eczema as an Illustration; Eczema ascribed to a Blood-Poison. 4. Will the Action of Remedies bear the same Explanation? Recurrence of Disease when the System is under the Influence of a Remedy; Recovery under different Modes of Treatment; Illustrations of the Way in which Remedies may be supposed to act: I. Scarlatina; II. Eczema; Attraction of vital Power into, instead of from the affected Part. III. Erysipelas. IV. Boils; The Vis medicatrix Naturæ; Death without visible pathological Change as Evidence of the vital Power Theory; Sudden Death from Poison of contagious Diseases.

NOW is the Poison got rid of?—To this question too, physiology has but one answer. By the time that the virus has multiplied to the necessary extent, the frame is stirred up to resistance, and then the skin, by a salutary effort as I have heard it called, expels the intruder, and with it some element previously in the blood; so that however much the patient may afterwards be exposed to infection, the risk of taking it is either entirely averted or materially lessened. So be it. Those whose faith carries them to the previous stage will have no difficulty in believing this part of the

story, and those whom these lectures have not yet convinced are not likely to have their old convictions shaken by any farther argument. But don't let us hear any more about salutary efforts, for assuredly it would have been easier for Nature to expel the poison in its original state, than when it had acquired such dimensions as to threaten life, and more rational to get rid of it before it had damaged vital structures.

2. *Is there anything in disordered Actions which militates against the Theory?*—It is now time to take up this question, which I shall however cut very short, seeing that it is one which the author of a theory can scarcely be expected to answer fairly. However free he may think himself from the desire to secure a present triumph at the cost of strict reasoning, he cannot always prevent a dominating train of thought from interweaving itself with his views on the very topic about which he, most of all, wishes to give a dispassionate opinion. He may feel as strongly as man can feel, that, however sound his views may be, nothing could prejudice his hearers more against them than bolstering them up in any faulty part, and yet for all this unconsciously commit the very mistake he is most solicitous to avoid. I ask you therefore to understand, that when I say, I have found nothing in any morbid actions studied by myself, which wars against the vital power theory, I do not claim to have it considered that the question is decided in my own favour. You must please take the decision arrived at for what it is worth, and that is very little indeed till the matter has been farther looked into. This much however I may distinctly state. Having carefully examined the course of

skin diseases, I believe the train of actions to be in every one of them the same as in scarlatina or tetanus, that is to say a noxious agent attracts the vital power in a particular way to the seat of impact and thus induces a specific and definite series of symptoms ; and this either by direct reflexion to the part as in the case of scabies and tinea, or by indirect, as when mal-nutrition or disturbance of the stomach is reflected upon the skin in the shape of eczema or urticaria.

3. *Will the Progress towards Recovery bear the same Explanation?*—This is the next question, and it is scarcely requisite for me to point out that the answer must depend upon whether you accept the doctrine as regards the progress of disease, for if you rule that it is to be rejected, there is an end to the argument. But I will suppose you are so far satisfied with it as to care to pursue the train of reasoning ; in that case I propose to take the group of diseases previously selected, and see what can be gleaned from observation of their later phases.

I. *Recovery from Scarlatina as an Illustration.*—I will begin then with the patient described as suffering from this affection, and examine him at any supposed time from two months upwards after his attack, and for the sake of clearly contrasting his present with his former state we will assume that he has perfectly recovered. His appetite, which was lost, has returned ; he eats well, enjoys and digests his food ; the capacity for learning and exercise has been regained ; the temperature of the skin has fallen to the normal standard ; the pulse is forty or fifty beats lower than it was, and the suppressed secretions have reappeared. It is *therefore* clear that in some functions greater activity is

now manifested and less in others. Then unless the whole argument is radically unsound, the second state of the patient must mean the presence now of a greater amount of vital power in parts torpid during illness, with lessened amount in those which were then excited to over-action. And everything I have observed tends in my judgment to show that the quality of scarlatina virus is to produce an impression at the seat of impact, reflected back I presume from the nervous centres to the skin and throat ; that this impression lasts a certain number of days, just as a sound of a given degree of loudness produces an impression which lasts a certain number of seconds ; and that recovery means a return of the mobilized vital power, mobilization being assisted by treatment, towards its normal seats, occasioned by the ever growing necessity for its presence in them to carry on the work of life.

These Changes usually attributed to Elimination.—Every devout believer, however, in the zymotic humoral theory is bound to ascribe such amelioration to the patient's system being now freed from the incubus of the blood-poison, which, while circulating in it, had depressed the vital energies and at the same time quickened the pulse, raised the temperature and augmented the transpiration. To this the answer must be that the humoral theory, inherently feeble throughout, is peculiarly vulnerable here ; and that the hypothesis of the elimination of a blood-poison is the weakest part of a weak argument. Indeed the difficulty is not to decide whether it can be assailed, but to determine which is the most evident of its many defects. Were it brought into court I should think it would be looked upon as one of the

very worst cases ever pleaded, both probability and fact being on the other side, and the only point in its favour being the old excuse for bad law, that it is convenient and that an evil is better than an inconvenience.

Probability is entirely against it, for, as I have endeavoured to show, there is not a symptom, internal or external, seen in scarlatina and indeed in any of the exanthems, which is not met with under a modified form in diseases not attributed to blood-poisons, and where the patient consequently recovers without elimination. Fact is still more adverse. In the exanthemata the more effectually the elimination of the poison through the skin is moderated by means of cooling drinks, light bed clothing and fresh air, the better does the patient feel, and the less strain is there thrown upon the constitution. No treatment answers better in scarlatina than greasing the entire surface of the body, yet unless the patient was varnished from head to foot, I know of no method by which elimination could be more effectually restrained. The zymotic humoral idea would be that such a step must be followed by serious consequences, whereas nothing of the kind ever takes place; a difficulty which, capable as the doctrine is of adapting itself to sudden and unexpected emergencies, looks to me fatal. So far from any bad results following, the most noticeable effects of inunction are a rapid fall in the pulse, prompt alleviation of the general distress and restlessness, a shortening of the suffering from the disease and its sequelæ, absence of uræmia, and a reduction in the mortality caused by this complaint. That these changes are accompanied by lessening if not prevention of elimination, we may feel assured,

because patients treated in this way rarely communicate the disease. In the name of reason then I ask what all this means, unless it be that experience runs counter to theory?

Accordingly we need not be surprised to find that eminent and successful practitioners, like Radcliffe and Sydenham, justly ranked as great observers, who founded treatment on what they saw at the bedside; and who, if they talked like staunch humoralists, still never allowed theory to get the upper hand of common sense, should have so strongly upheld the value of the cooling regimen in small-pox, a mode of treatment in which fact directly contradicts hypothesis. Naturally enough such a method is utterly scouted by the laity, who are convinced that there is something in the blood which ought to be got rid of, and therefore endeavour to assist the process by means, which a very superficial scrutiny of the records of medicine shows to be fatal in proportion to the thoroughness with which they are carried out. To the enlightened practitioner such work seems equally shocking and ridiculous; but he must admit that in point of consistency the layman is ahead of the physician, who teaches that smallpox eruption is due to the elimination of a poison from the blood, and yet treats the disease in a way very much calculated to keep that poison in the system.

Smallpox having been so much studied, we are enabled to draw some further materials from its phenomena. One of these is that the most fatal day in the course of variola is the eighth day of the eruption, the very time when, according to accepted views, the constitution ought to be quite freed from the virus by the maturation of the pock. Out

of one hundred and sixty eight fatal cases the dreaded termination took place on this day in twenty seven or nearly one sixth of the whole. Another is that a mild attack, in a certain proportion of cases at least, guarantees the constitution as effectually as the most severe outbreak, so that the susceptible ingredient being drained off by such mild means, any greater display of them is a mistake on the part of Nature. Besides the extent of the eruption in small-pox can be materially diminished by cooling diet, fresh air, gentle aperients and covering the surface with zinc ointment; but if the pustules be Nature's signal that she is trying to eject the lethal element, then reducing their number, or diminishing the secretion in them, must mean detaining in the system an amount of virus proportional to the difference between the natural and the artificially lessened eruption.

The processes of life are frequently compared to those of organic chemistry and even to those seen in pure physics. There are authors who have maintained that life itself is a purely chemical series of actions; man, they hold, burns like a furnace with a windpipe for a chimney; he consumes oxygen and gives out carbonic acid just as a fire would. As I understand Dr. Burdon Sanderson man is a human steam-engine. It seems to me that the analogy gets into a nice mess when we reach the humoral doctrine of small-pox, for what is there in the regular operations of physics and chemistry, which parallels a lasting change being impressed upon a given mass of matter, with equal force by a large and a small amount of perceptible action, by the *introduction of a large or a small amount of some highly*

active ingredient? And what chemist, out of Laputa, who required to have a fluid freed from some destructive element, would endeavour to assist Nature's process for the expulsion of this by detaining it in the fluid?

But indeed everything connected with zymosis, ferment and blood-poisoning seems to exert a benumbing influence on the human intellect. Brodie, president of the Royal Society and the Royal College of Surgeons, tells us that the fever of smallpox abates when the eruption comes out, and asks whether this may not be explained on the supposition that virus is generated and accumulated in the blood, a process followed by its expulsion. He evidently answers the question in the affirmative, and then seals the conclusion by the extraordinary argument, that transfusing the blood of a glandered horse into the circulation of a sound one will bring on farcy. The whole chain of reasoning is at fault. The eruption does not in any way supplant the fever; it simply succeeds it. The two keep pace with each other as regards severity. The formation of the vesicle is as much the beginning of natural decline in the morbid action of the skin, as the diminution in the heat, and in the rapidity of the circulation, is evidence of a lessening in the action impressed upon the system. The greater the evolution of pustules, that is to say the more completely the blood is being freed from the virus, the higher does the fever rise, while it must at the same time be borne in mind, that fever spontaneously abates in other diseases without the maturation of a poison. As to the farcy, Sir Benjamin had better have let that part of his argument alone; it could only be known by visible signs that the animal had glanders, and &

however ought certainly to be adopted by every person who believes in elimination ; moreover the tonsils and skin ought to be stimulated in scarlatina and smallpox, and the conjunctiva in measles ; in short, many modes of exciting the emunctories to healthy vigour which are now neglected, should be put in force, the duty of a true humoralist being evidently, as Raphael put it about painting, to improve upon Nature.

Depression of vital Powers considered.—Those who see in the first stadium of an exanthem, or any disease they may choose to ascribe to blood-poisoning, evidence of the reception and multiplying of the virus, who attribute the confusion of thought and delirium of its later stage to depression of the vital powers from the circulation of this tainted blood, and the altered state in recovery to the blood being freed from the pernicious invader, and consequent re-action of the vital powers, introduce an unnecessary element of confusion ; for they do not tell us what these vital powers are, and for my part I do not understand what is meant by the phrase. The vital actions seem to me only depressed on one side in proportion as they are intensified on the other, which I suppose means that the sum of action remains the same.

II. *Recovery from Eczema as an Illustration.*—I will now take the case of a person convalescent from a bad attack of this affection. The symptoms have not resembled those of scarlatina, but they have been severe enough in their way ; feverishness, coated tongue, loss of appetite, lassitude, despondency, thirst, rheumatic pains, the well known morbid *state of the skin* followed by dryness and itching ; perhaps

also sleeplessness, flatulence, dyspepsia, and some degree of bronchitis. These have passed away as completely as the eruption of scarlatina, without their disappearance being attributed to the elimination of a virus. The patient, indeed, if of mature age generally either knows of his own knowledge, or gets assured from the state of his internal convictions, that he has had blood-poisoning, but medical men seem to have allowed the existence of a distinct blood virus to fall here into desuetude. It may be urged, and certainly such things are said, that the blood of a person with eczema is in a bad state, much the same indeed as if it were poisoned. But in the first place nothing of the kind has ever been demonstrated as a constantly present cause, though eczema seems as specific as scarlet fever; and in the second place a certain degree of eczema may be cured by local means, which, while they evidently act on the skin, cannot be supposed to do so on the blood generally.

Eczema ascribed to a Blood-Poison.—It may assist the argument if I remind you that till quite lately eczema was viewed generally, and is still only too often viewed, in much the same light as the exanthemata; that is to say it was practically attributed to a blood-poison in this much, that the discharge was looked upon, like the efflorescence of scarlet fever or the pustules of smallpox, as a wholesome effort to free the system from lethal matter; an effort which no one ought to arrest, imprudent stoppage of the drain having been followed by apoplexy, bronchitis and pneumonia, besides entailing a host of less defined ills, conveniently spoken of as serious internal symptoms. At the time I speak of one author was in the habit of recommending that,

before an attempt was made to cure eczema, a vicarious discharge should be set up means of a blister or seton, it having apparently never struck him that, if the condition of the patient were bad when part of the serum was prevented from flowing away, it must have been desperate when the whole amount was in the body. Here then we have the engineering idea in all its beauty. Disease means the presence in the frame of an incompressible fluid ; dam it up in one direction and it will break out in another. Superficially looked at, the clearness and simplicity of the view stand unrivalled ; consequently this easy mode of explaining a morbid process has ever been a great favourite. Its besetting defects are that it is wholly imaginary and explains nothing.

For many years I have taken every opportunity of pointing out the misery caused to patients by keeping up the delusion that a discharge is ever beneficial. I showed, I believe the first time it was shown, that such a secretion is not salutary but morbid ; that the longer it goes on and the more profuse it is, the more completely is the patient's health undermined ; that so far from warding off it renders the sufferer more liable to disease ; that an attack of internal affection, if of a prostrating nature, usually, instead of carrying eczema off, entails a relapse ; that it is impossible to repel eczema by any means whatever ; and that it is only radically cured, especially if extensive, by means which generally improve the health, the inference from all which is that it can never be cured too quickly. At a meeting of the Medico-Chirurgical Society I asked the supporters of the *humoral* theory to show a single instance in which the cure

of eczema had brought on internal disease, and I have waited ever since for one.

Under one form or other medical literature may be said to teem with allusions to the humoral doctrine. A moderate volume would hardly contain what has been written about one offshoot from it, the ferment theory. But sad as such waste of time may seem, it would be but a little matter did the mischief end here, and it does not; the lecturer who undertakes to explain a morbid change by comparing it with a process which, when scrutinized, proves to be different both in its course and results, misleads his hearers. He has not elucidated the problem; he has merely substituted a fanciful analogy for a confession of ignorance. The student thinks he has learned something whereas he is as far from the truth as ever. Worst perhaps of all, a loose way of thinking and speaking is engendered; the spur to seeking out the right path by dint of careful observations is blunted; he is fitted out with a theory which makes every thing clear, and therefore knows everything worth learning; why then should he search farther when so many able men are content with the explanation which is offered him?

The system has its advantages. The scholar, who is taught such an easy method of explaining pathology, must feel as a man, into whose hands an enchanted sword has been put, might be supposed to feel, and looks upon himself as raised to a level with his master. "Nothing," says Dr. Adams, "is more flattering to the vanity or favourable to the indolence of the human mind, than that language which seems to teach us the result of a proposition without the necessity of attending to demonstration." Another advantage

is that the system settles some awkward questions almost before they are put. There is no necessity to ask a man, who explains everything by such a theory, whether he has any facts or experiments to bring forward in support of what he is saying. No one is expected to prove what is admitted on all sides; the operations of the human mind must soon come to a standstill under the pressure of so obstructive a system. Again, a difficulty, settled by means of a theory, and especially of one related by ties of consanguinity to branches of exact science like chemistry and morbid anatomy, is solved in a way which we are taught to consider at once philosophical and respectable. I cannot say that I quite understand the meaning of these terms, especially the first, though I feel assured that I ought to do so, for it seems to possess some mysterious quality entitling it to veneration. In a digest of the examination of several members of the profession on a medical question, the committee, who summed up the evidence laid before them, stated that the theory which they offered was "more philosophical" than that which they had decided against, and I assume you have all heard of some mode of treatment being rejected on the ground that it was not physiological, which I suppose means much the same thing. If you have not, then I certainly have heard of such things.

But these advantages, if advantages they be, are more than counter-balanced by heavy drawbacks, and Dr. Adams might have wound up his pungent remark by adding, that constant recourse to a theory is like a constant use of stimulants; the relish for plain facts, unaccompanied by an *appeal* to the favourite doctrine, is soon lost. A guest at

the Castle of Indolence was not more unfitted, by his stay there, for the wholesome and necessary occupations of life, than a man, who accustoms himself to explain everything by a blood-poison, a ferment or a germ, is disqualified for that resolute exertion of the will which is requisite for saying boldly, that he does not understand what some given disease is due to.

It is however really a mistake to speak about anything being explained by zymosis or poisoning. The cumbersome machinery of the shape and nature, of the genesis, growth and final expulsion of the virus, has never yet been defined in terms sufficiently clear for practical life; the whole thing is in a haze. The simplicity of the doctrine is only seeming; the crucial test of a proper description is evaded, and a meaningless term is offered as a substitute. Nor do I venture to assert that the vital power theory explains disease, for there is much of which we are, and possibly ever will be, ignorant; what I contend for is that it is more in accordance with facts than any other theory, and that it shows quite as well if not better in what way certain agencies may set up disordered action. The reproach that it is meagre to a fault I at once admit, for I regard this as one of its best credentials. After a theory has once made its way, we may observe that its chief characteristic is a simplicity which rather disappoints expectation; indeed the better it is established, the more do men come to speak of it as one of those common facts which require neither proof nor definition. There is no difficulty in understanding what this theory enforces, *that any noxious agent may set up a specific particular action at the seat of impact*, and that the

impression made there is conveyed to the nervous centres, and reflected back from them to the skin and other parts, *in a special and particular way consonant to the nature of the exciting cause*; for the one postulate is in unison with what we can see for ourselves, and the other with what is revealed by careful experiment.

There is equally little difficulty in understanding that heightened activity in one function means lessened activity in another, for this question too is one of observation which every man can verify. Lastly I cannot conceive any difficulty in comprehending that the agencies which generate disease do so by attracting the vital power, *in a manner peculiar to each*, towards that part of the frame with which they come in contact; for attention to the operation of two or three hostile agencies, such as heat, cold and poisons, will show that they do set up a special action at the seat of impact, that this action may be reflected not only to the part assailed but to others, and that every injurious factor acts in a way more or less different from all others. You can also convince yourselves that objects even influence the system without being conveyed from the one to the other, as for instance when the sight of a precipice brings on giddiness, or that of blood fainting and sickness. Hence it seems a natural inference that all forms of matter and motion have each a specific action on the frame, and that each such mode of action, from the furious speed of the electric flash to the gentle and often welcome touch of seemingly innocuous elements like air and water, is, if applied over a large enough surface and with a certain degree of force, adequate to produce an augmentation of the natural functions of the part it

is applied to, capable of passing into disorder and disease, and that these changes are continually so produced.

The formula of all diseases due to external causes, if not also those of internal origin, being only so many expressions of this law of impact, appears to me both simple and comprehensive. No doubt I am prejudiced about it, but I submit it to your notice with this flaw in its title to acceptance. If the objection be made that it is as yet but very incompletely attested, I reply that I am most desirous to have it submitted to stringent examination, and that farther arguments in its support are yet to follow. I am quite conscious that others may see the whole question in a different light. I even feel sure beforehand that some will condemn the hypothesis; still, after carefully weighing everything, I have come to the conclusion that the evidence is in its favour. I know that far more scientific explanations, or at any rate what look more scientific, can be given; and that these are supported by all the force which great names, time honoured views, and a perfect host of authorities can lend, so that I almost feel as if I were breaking, with sacrilegious hand, into some sanctuary hallowed by the veneration of ages.

I am well aware too that conviction is all against me, and that I am asking you to act in a way which I cannot profess to set an example of, that is to lay aside all bias, while I myself do not feel in the least sure about being free from it. The conflict, also, between the vital power theory and one based on any form of humoralism, is so utter that every plea, set up in defence of my own views, must wear the form of an attack on long cherished opinions. But I cannot

afford to care for anything but success, and am compelled to see all facts through the medium of their value as evidence.

4. *Will the Action of Remedies bear the same Explanation?*—This, the last of the four questions proposed as tests, must, I contend, be answered in the affirmative, but with certain important reservations. In the first place then, the action of many remedies is so much below that of those natural to the frame, so little in harmony with them, as to be, if illustrative, still very subordinate. Next I must admit that my own researches are very incomplete and fragmentary, for though I have, during a long series of years, treasured up pretty well all the facts I could collect bearing upon the subject, it is to be remembered that the labours of one person can do little in so large a field. What few observations I have to offer are a good deal mixed up with other matters, as indeed is apt to be the case with clinical contributions. I should like to see the question far more completely tested, as I think the result would be to support the vital power theory, for I consider that I have watched the operation of treatment long enough, and on a sufficiently ample scale, to justify me in awaiting the verdict with a fair degree of confidence; unless my observations have quite deceived me, the results of such an inquiry would not only lend assistance to what has been previously urged, but would help to prove that remedies act upon the same principle. Consequently, when a medicine is really strong enough to overcome a disorder, I submit that it operates by attracting the vital power to parts of the frame different from those involved in the diseased process; and as the

action thus set going, being artificial, is more easily diverted than one so allied to natural functions as disease, the result is that the vital power flows more readily from the seats of it back to the normal channels. All questions as to the qualities of medicines, their being diuretic, purgative, and so on, may be treated as subordinate matters of detail which do not affect the point at issue.

Recurrence of Disease when the System is under the Influence of a Remedy.—It seems to me that there are many facts fatal to the doctrine of the blood being more implicated in disease than the solids, for when this fluid must be supposed to be saturated with a remedy given to expel a complaint, in what part of the frame can the malady be supposed to take up its abode in cases of relapse? Yet such relapses are constantly happening; I will take three out of many. Iritis has been known to attack the right eye when the patient was taking the largest doses of turpentine for the same affection in the left eye; erysipelas returns when the patient is still drenched with tincture of steel, and lepra while he is daily plied with arsenic. Incidents of this nature make one suspect that the absorption of medicines is as much a mere concomitant of their therapeutic action, as an inoculable state of the blood is a purely chance accompaniment of certain diseases.

Recovery under different Modes of Treatment.—I suppose no one will deny that almost every disease, not necessarily fatal, has been cured by different and sometimes totally opposed methods of treatment. For instance in scarlatina success has followed the use of antiphlogistics, antiseptics, tonics like steel and bark, stimulants, notably wine, brandy and ammonia, cold affusion, and frictions with fat. I will

not enter upon the vexed question of which has answered best, I simply assume that every system has saved some lives. Indeed this must be granted by the respective advocates of each system, and I believe it to hold good of the majority at least. It seems to me incredible that so many able and painstaking men, most of them justly renowned for their success in practice, could have gone on treating disease for years, and never once noticed that cases left to themselves, of which they must have seen many, did quite as well as those on which they expended so much care, and that warning mothers against neglecting scarlatina was a piece of gratuitous interference.

I will therefore, at the risk of being wrong, take for granted that every plan, advocated in modern times by a judicious physician, as practically useful in scarlatina, does possess some control over this disease, and if it be admitted that each method saves one more life out of every hundred than the unaided powers of the constitution can do, enough is gained for the purpose of argument. Taking this then as a standing ground, I ask if any known physiological theory can reconcile such a discrepancy as that of two similar cases of a specific disease like scarlatina, unalterable in its type, being cured by such directly opposite modes of treatment as the antiphlogistic and the stimulating; or if chemistry can tell us how it happens that sesquichloride of iron and sesquicarbonate of ammonia act in the same way upon a diseased fluid. Yet the difficulty seems in my judgement to vanish when we admit, what I believe extended observation will compel men to admit, that each remedy *acts here by attracting the vital power in a particular and special way*

from the arena of mischief to its point of impact, and that the structures of animal and organic life attract it from there to its natural channels more easily than they could have done from the seats of disease.

Illustrations of the Way in which Remedies may be supposed to act.—I. *Scarlatina*. I now proceed to give a few instances of this, confining the observations to diseases already touched upon and beginning again with scarlatina. I have also restricted them to remedies supposed to operate in the way contended for, as there are many which pretty obviously act by relaxing various forms of constriction, or removing some mechanical impediment to the due performance of functions, or again by cutting off the access of injurious agents, and it would lead us too far out of our way to discuss all such topics. What is aimed at here is to give a clear shape to the views already stated, and for this purpose I have employed the help of a diagram. Supposing then the sketch to represent a person labouring under scarlatina, the double continuous line A A A

FIG. 9.
Scarlatina. Increment.



will stand for the inflamed skin, B for the heart and vascular system, also surrounded by a double continuous line to show their increased action; and C C C for imaginary lines of transpiration, this function being likewise supposed to be considerably increased. On the other hand the dotted line D will represent the brain, E the stomach and intestinal tract, F F F the muscular system, and G the kidneys, all acting with diminished energy.

Applying now the diagram to the action of medicines, let us suppose that the patient has taken sesquicarbonate of ammonia, and that this remedy has cured the disease by acting upon the stomach.

FIG. 10.
Scarlatina. Progress towards Recovery.



I do not say that it does either, but that it possesses some amount of curative power is almost proved, and ammonia does act upon the stomach. The diagram is constructed to show the supposed process of cure. Let then A A A represent the skin, the lessened action of this important structure, as of the heart, being shown by the dotted instead of the continuous inner line; B will now show

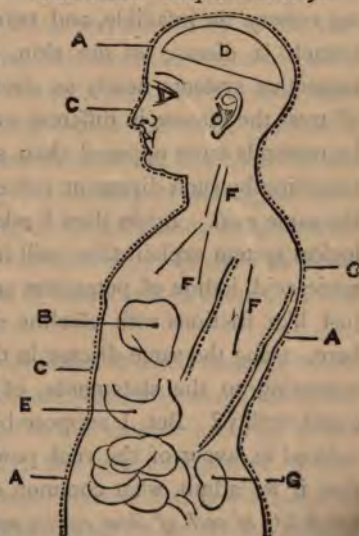
the heart in its reduced state of action, and CCC the transpiration, the effect upon which is pointed out by the shortening of the lines. The increase of power in the brain, stomach, muscles, kidneys, &c. is marked by the double dotted lines at D, E, FFF and G, it being assumed that these parts are still weak.

The next diagram being supposed to show complete return to the normal state under the influence of treatment, all the parts involved are pointed out by means of simple lines, transpiration being however represented by mere dots. The letters being the same, a brief comparison will I trust suffice to show the meaning of this one.

II. *Eczema*.—The next subject I would propose for examination is the action of medicines in eczema, a disease which is undoubtedly under their control. Whatever may be urged in support of the proposition, that the course of scarlatina is uninfluenced by treatment, such reasoning could not apply here. When a case of eczema, which has for years either remained stationary or been getting worse, all at once begins to improve under treatment, and when

FIG. 11.

Scarlatina. Complete Recovery.



we see the same thing happen hundreds of times from the use of the same remedies, we are justified in looking upon their curative power as proven. Farther I will suppose, and I am only putting a case which you have seen often enough, that a case of eczema has been cured so far at any rate as regards visible symptoms. By and bye the patient's health deteriorates under the wearing influences of over-work and anxiety ; he is attacked by rheumatism, gout or bronchitis ; the eczema reappears ; he neglects it and the longer he does so the worse it becomes, till at last the symptoms grow so urgent that he is compelled to seek the aid of his medical attendant, who sets him right by the use of the same means as before, and this may happen over and over again.

Now at least two surgeons speak of their method of treating eczema as infallible, and two physicians, whose special branch is disease of the skin, advance claims for their respective systems nearly as strong. Yet these gentlemen all treat the disease in different ways. There could scarcely be methods more opposed than some of them, but though travelling by such divergent routes they all manage to reach the same goal. Again then I ask, does any known physiological system explain this ; will it tell us why quinine, steel, nitric acid, iodide of potassium and magnesian aperients act just like frictions with alkaline soap, as they manifestly do here, curing the same disease in the same constitutions and, according to the statements of authors, apparently with equal facility ? But, I suppose because I am so much prejudiced in favour of the vital power theory, it seems to me that if we admit, what common sense loudly proclaims, *the possibility of each of these agents acting in its own special way,*

and on the particular part of the frame for which it has a special affinity, thus attracting the vital power to such part, from whence it is again more easily withdrawn by the daily wants of the economy to its normal channels, much of the difficulty is solved. The first part of the postulate must, I think, certainly be admitted, as each of these remedies can be observed to set up a special action.

Attraction of the vital Power into instead of from the affected Part.—You are no doubt quite familiar with a fact which seems in strong opposition to the theory advocated, and you might therefore very well be supposed to urge as follows. “In a well known plan of treatment, that of Hebra, eczema is cured by applying to the seat of disease an alkaline caustic of such strength, and with such frequency, as to set up considerable irritation; according to the very arguments used in supporting this doctrine, the vital power must be attracted into the diseased parts and not away from them, as the line of reasoning which has been pursued is intended to show.” As many examples of this contradiction might be found, one being the healing of a sluggish ulcer by applying a blister over it, I will endeavour to give what seems to me a solution of the difficulty, especially as doing so will assist the elucidation of other points connected with the subject.

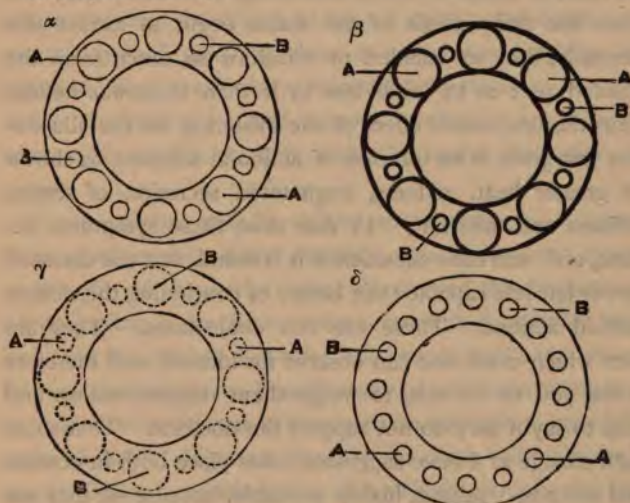
In the first place it is to be borne in mind that in eczema, and probably many other diseases, all the tissues of the affected part are not equally engaged in the morbid process; in the second place that, provided the agent employed is only energetic enough, a very small area of action will admit of a great deal of disturbance being set up, as may be seen in

the thrusting of a fine needle into the skin, where a scarcely perceptible puncture of any blood-vessel is followed by sharp pain; in the sting of the wasp, nettle and so on. For all this I do not contest the point on the ground that part of the skin assailed by eczema remains intact, for I will take the strongest case against the theory and try to show that, for a remedy to act by attracting the vital power into the very seats of disease, in no way militates against it; this I will attempt by a diagram. There being, in the imaginary case selected no very visible disturbance of the health, the local action of the remedy and that of the disease are alone represented, though I believe assimilation is usually at fault when eczema is severe, as I never saw it cured in this state without some improvement in the health, and this is generally effected by means calculated to improve assimilation.

Let then α represent a patch of eczema in any state the reader chooses to fancy, let the circles A A stand for the supposed state of the structures engaged in secreting serum, and B B for the other portion of the skin. Next let β be the same patch after a caustic solution has been applied. The result is to bring on great pain, abundant discharge of serum and a kind of charring of the surface; the structures therefore pouring out the serum may be looked upon as more inflamed, a condition supposed to be indicated by augmented size of the circles A A, while in accordance with the hypothesis, the increase of vital action at B B is shown by enlarged size and somewhat darkened outline. In γ it is assumed that, although the structures are still under the influence of the caustic, restoration to health has begun, and an endeavour is made to represent this by breaking

FIG. 12.

Attraction of vital Power into Seats of Eczema. a. Before Application of Caustic. β. After Application. γ. Progress towards Recovery. δ. Complete Recovery.



the outlines of both A A and B B, while again in the fourth compartment δ , there being a supposed return to health, both A A and B B are in consequence assumed to have regained their natural condition, and to be again equal to each other.

No person can be more conscious than I am how faulty this diagram is, but as regards the principle it is intended to expound, I see every reason to believe that on some points at least it will be strengthened rather than weakened by time and observation. And whether these two great arbiters shall decide that the vital power is attracted by such

applications, not merely into some but indiscriminately into all parts of the diseased surface, as seems by far the most probable, I believe the action to be fundamentally the same; the remedy seems to act by mobilizing the vital power, and when the daily needs of the frame begin to attract this generally, they are enabled to withdraw so much from the affected part as to leave less in it than there was before. Thus the first visible effect of the blistering in the illustration just given is an increase of action at the part, as shown by greater heat, redness, augmented secretion of serum, stiffness and smarting. In due time these symptoms decline, and with their subsidence it is found, that the diseased part is left less capable than before of continuing the various morbid actions. These are not conjectures. They are facts which every one can observe for himself, and therefore I ask you to do this, to weigh them dispassionately, and then to say if they do not support the doctrine. That some such change as I have suggested takes place both in eczema and ulcer is, I submit, highly probable, because we may see with our own eyes a new action ingrafted upon the old.

As regards eczema, some of you may object that remedies like iron and acid, which are so often useful in this complaint, act by increasing the nerve force, that being I believe the favourite theory, or rather expression, just at present. But one very important factor in any such objection, the existence of the nerve force itself, has never been proved; indeed I have not yet met with an attempt to describe it, or to define stringently how it acts. The writers I have consulted, who employ the term, limit themselves to assertions *which are as vague as they are positive, and are wise in*

doing so ; any attempt at exactness might be a hazardous step. When the fight is not for truth but for victory, the safest plan is to use boldly the terms which others use, without inquiring over scrupulously whether they are correct or not, seeing that for a time at least a certain degree of currency is gained, and the door is easily closed against all argument when the decision is taken beforehand to listen to none. Success of its kind is assured under such a system, whereas it might be very doubtful under the reign of reason.

But in another and far nobler sense they are mistaken. Silence effected by mere assertion means no doubt assent on the part of those who have not studied the question, or whose suffrages are of no value ; but with those who have mastered the subject it simply indicates a desire to escape fruitless discussion, for I need scarcely say that any attempt to reason with persons who use these wild terms would be waste of time. However there is this consolation always in store. These symbolic modes of speaking are only so many fashions, so many emblems of fetich worship, before which all minds are expected to bow, which successively receive their stamp and take their shape, not from their intrinsic worth but from their convenience as expressions of the scientific cant which imitates the science of the day, which has so often cast its dark disfiguring shadow on the history of medicine, and so often laid it open to ridicule. Although their worthlessness is perpetually being demonstrated by the fact, that when dethroned by some new favourite no earnest attempt is ever made to restore them, yet each system in its turn is regarded as infallible, and reigns with undisputed

sway till the hour of its fall arrives, and it passes away to return no more. So inevitable indeed is the doom of each successive fashion, that it is really a question whether things so ephemeral in their nature, so certain to perish in due course of time, and indeed only born for this end, need be discussed at all.

III. *Erysipelas*.—This disease will serve as the third illustration, and in order to encumber the argument with no recondite points, it will be better to confine ourselves here to the idiopathic form of the affection. This, I need scarcely say, has been treated by some of our most eminent physicians on totally opposite principles, and in every case with equal success. Out of the various methods four may be selected which have at different times met with strong support. 1. The antiphlogistic, comprising of course bleeding, tartar emetic, calomel, black draught and digitalis; a method which, whatever effect it might have upon the erysipelas, impaired the constitutions of men and women by hundreds till the strong hand of Dr. Dickson restrained the destructive practice. 2. Incisions rather more than twice the size of average sword cuts. 3. Stimulants such as bark, wine and ammonia; and 4. Tincture of sesquichloride of iron. Well might Sir Thomas Watson say there is a most embarrassing difference of opinion about the treatment of this disease, and I think the inability of so firm a believer in the humoral theory to find, in his favourite doctrine, any clue to the solution of the problem, suggests, as highly probable, a suspicion that it may not be found there at all.

IV. *Boils*.—I will take this as the last example. Since

Hunter's time, then, the common furunculus has often been treated successfully by means of large doses of liquor potassæ. On the other hand Sir Thomas Watson says he has found sulphuric acid a better medicine, and I need scarcely remind you that the beneficial action of yeast has been warranted by men well able to judge. There are other remedies which I forbear to mention, the above being sufficient for the purpose in hand, that of showing that the disease is cured by means so irreconcilably different, as to negative the supposition that they can, conformably with any existing hypothesis, act in the same way; yet I believe the vital power theory explains away this difficulty, just as it does that about the remedies for erysipelas.

The Vis medicatrix Naturæ.—We are told by a modern and very able writer on medicine, that the existence of such a power as this remains to us a perpetual problem in practice. Under the rule of humoral and zymotic doctrines it would remain equally so in theory. It only needs that you should scan carefully the language in which this process is spoken of, even by cautious observers; you will soon convince yourselves that it would be anything but easy for them to pourtray in words a clear and satisfactory outline of such a power, and in point of fact this is admitted by the writer referred to. One is quite prepared to hear that the votaries of the humoral theory have found it a stumbling block. If it existed from the beginning of life, there would be a necessity for assigning it some defined seat in the human frame; and while it would be superfluous in the healthy, it would often be inadequate and manifestly is inadequate, when most wanted. We could scarcely suppose

it to be generated from day to day as is said to be the case with the nerve force, because there is no machinery for expending it, and it could not very well be produced at the time it is wanted, unless we assume such very contradictory qualities in the causes of disease, as those of evoking both the latter and its antidote at the same moment. But it seems to me that the employment of the term is simply equivalent to an ambiguous way of putting the law I have tried to lay down, namely that the vital power so constructs the various parts of the human frame, that they imperiously require its presence for the execution of their functions, and that the *vis medicatrix* means the constant tendency, thus set up, to recall the vital power from the seats of disease to those of daily normal action. Were there any such power as that spoken of in the dreams of humoralism, it would be most improper to give medicines for any purpose whatever.

Death without visible pathological Change as Evidence in support of the vital Power Theory.—I think if it can be shown that death may take place from shock, without any appreciable cause being revealed by autopsy, and that in many forms of disease we meet with no constant or reliable signs after death, we shall have advanced some way towards an absolute demonstration, that the essence of disease consists in the attraction of the vital power towards the impact point of the morbid agent. Indeed, if there be one argument by which more than another I would desire to see the whole theory tried it is this, for I contend that this part of the hypothesis is thoroughly upheld by facts.

Thus we have an entire group of diseases in which

nothing is found after death that throws the least light upon their pathology. This is the case with tetanus. About hydrophobia and epilepsy we hear of the absence of all definite or constant traces of organic change. Excessive pressure on the brain producing fatal coma, and defect of pressure bringing on fatal syncope, have the like history. Sudden death after paralysis of twenty years' standing the same. Numerous examinations of the body after death from mercurial erethism, asthma, painters' colic and diabetes give similar evidence. To what then do these facts point, except to *the essential action in disease being that which I have ventured to lay down in the foregoing paragraph*, be the concomitant symptoms what they may?

Sudden Death from Poison of contagious Diseases.—A farther proof of the fundamental action in disease being of the nature I have just mentioned, is, I submit, furnished by what we see when some of the affections, attributed to blood-poisons, run their course so quickly that the system is at once overwhelmed by the first assault of the toxic agent. In typhus of this degree of virulence the patient rapidly becomes stupid and bewildered, the surface of the body turns cold and clammy, the hue becomes purplish, the pulse sinks with ominous speed, the coma augments with proportionate rapidity and death may even ensue within twenty four hours. In smallpox also we sometimes observe the same fearful train of symptoms, and still more often in the worst forms of scarlet fever. Yet I believe authorities are agreed, that in these cases there is no constant recognizable change to be detected by autopsy. I need not remind you how often similar facts have been made known about the

worst kinds of cholera, and in some epidemics plague is said to have cut off its victims in the same manner.

Here then we have the beginning, middle and end of a malady compressed into so brief a period as to leave no room for such explanations, as that death is due to multiplying of the virus, circulation of the poisoned blood and so on. As there is not time enough for such a fermentation as the ordinary course of these complaints is supposed to depend upon, we must infer that, if the disease can run through both its most important phases without them, they after all play only a subordinate part. But the poison, to have produced such dire results, must have entered the frame in considerable quantity, and as there has not been time for its elimination, *we ought to find some traces of it, which we never do.* In cholera indeed we have a change in the vital fluid, but that it is only a result, a purely secondary affair, is, I submit, conclusively shown by its being found, not so much in the worst cases as in those where the serum has been drained off by incessant purging, and by transfusion having quite failed in this disease. But if pathologists would simply examine the subject from the standing ground taken up in these lectures, if they would admit, what I maintain observation shows, that the lethal agent *acts by attracting the vital power to the part on which it is exerting its influence*, and that this fatal action takes place with such suddenness and energy as at once to drain the vital power from the structures of organic life, we should have a more clear idea of the question.



LECTURE IV.

The Alpha and Omega of Disease ; Death from Lightning ; Way in which Electricity acts ; Death from Poison ; Generation and Expenditure of muscular Force ; Generation and Expenditure of nervous Force ; Muscular and nervous Force not present in the Ovum ; Unity of Forces in the Frame ; Influence of disordered Actions on Ovum ; Complex Nature of Force communicated to Ovum ; Hereditary Nature of Diseases of the Skin ; Organisms ; Nature of vital Power.

THE *Alpha and Omega of Disease.*—But I will now try to damage the zymotic humoral theory still more by showing, if I can, that the middle stage of disease, with all its machinery of the fructification of the poison, is a superfluous invention ; and that an abnormal action may run its course and end in death without the possible introduction of any blood-poison, without the possible absorption of any injurious material by the blood, such as might be supposed to paralyze the heart's action or induce coma by circulating through the cerebral vessels. I propose to take an action which shall represent, with an enormously accelerated pace, the march of the deadly contagious diseases just spoken of. If this process can be demonstrated respecting one form of abnormal action, if we can prove *the existence of all the essentials of even fatal disease without the intervention of the blood poisoning agent*, and this too in cases which

will bear a very close comparison with diseases unhesitatingly ascribed to such causes, then it may be a possible mode of action in all. It seems to me that there is no getting over this fact, that we have here the alpha and omega of disease before us. We see or know that an agent assails the frame, and that the person exposed to it dies under its influence, without there being time for it to operate through the circulation. That *this is the great typical action*, that there is *no necessary intermediate stage*, that all the period intervening between the contact of the agent with the frame and the issue of this contact in death, *is entirely subordinate, a lengthening out of the first stage* so to speak, is, I submit, shown by what follows.

Death by Lightning.—This is the first illustration which I propose to offer of the theorem. Here the action is so sudden that it does not seem possible, by any known means, to compute the interval between the beginning of it and its termination in death. I have only had one opportunity of learning anything about the sensations experienced on being struck by lightning, and it was afforded by a woman who had been made insensible in this way. According to her statement the shock and unconsciousness took place at the same moment. She said she felt absolutely nothing except an instantaneous sensation of falling; as to everything else her memory was a perfect blank. We cannot question the dead, and therefore do not know that the sensation is the same, but I cannot see how we are to draw any other inference, if we are to judge by the suddenness with which people killed by lightning fall, and the *absence* of any cry, convulsion or after movement. Certain

facts connected with electricity render this conclusion very probable. Franklin inadvertently took a shock intended to kill a turkey. "The flash," he reports, "was very great and the crack as loud as a pistol, yet my senses being instantly gone, I neither saw the one nor heard the other; nor did I feel the stroke on my head, though I afterwards found it raised a round swelling where the fire entered as big as half a pistol bullet." On another occasion he accidentally received an immense charge through his own head. "He neither saw the flash, heard the report nor felt the stroke."

It may be said that death by lightning is death by violence and has therefore no sort of analogy with diseased processes. I admit the fact and demur to the inference on the following grounds. I have examined the histories of a good many cases, and have seen reason to believe that in every one of them it was only the surface that was struck, and that no internal organ was damaged by the electric fluid, or if this happened it was only a secondary or concomitant affair; in short that lightning acts like a vesicant of tremendous power. All that I have found described was a burnt appearance of some superficial part, sometimes the most remote from the heart and spinal marrow, as for instance the heel, calf of the leg or the side. This too is Brodie's experience. He mentions the case of a boy who was knocked down in a hovel by a flash of lightning which set the thatch on fire. He was drawn out of the hovel before there was time for the burning thatch to take any effect, and his clothes were uninjured; but shortly after large vesications formed about the pubis and thigh, showing that something had acted like a blister, and it is

difficult to understand what this could be except the electric fluid. Brodie gives some more facts, and then goes on to remark, that life may be destroyed in this way without injuring the organization of any part of the body so far as we can make out.

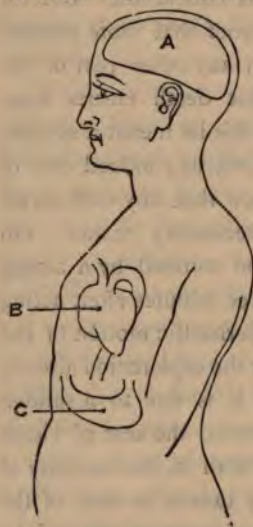
Brodie's account is confirmed by the evidence of Dr. Ogston in his narrative of a whole family being struck by lightning, the shock being so violent that extensive damage was done to the house. No one was killed, but on examining a boy who had evidently been struck on the left foot, he reports as follows. "From a spot below the great toe, evidently corresponding with the hole in the boot, an ecchymosed band one inch broad, and with scorched and blistered cuticle, extended in a wavy or zigzag direction for some inches up the leg to the centre of the inside of the left thigh." Some other parts of the skin "were similarly scorched and ecchymosed," while of a girl who was also struck, but on the shoulder, he says, "From the shoulder a scorched ecchymosed and blistered wavy line, an inch wide and exactly similar to that on the boy's leg, ran downwards over the right scapula to the right axillary region where it bifurcated; one branch passing down by the antero-lateral aspect of the body, crossing the right groin and passing over the right buttock and coccyx, where it joined the other branch; this other branch running in a zigzag direction, backwards and downwards from the axilla to the sacrum and coccyx where it joined the anterior branch."

Way in which Electricity acts.—Brodie seems quite of opinion that electricity operates by inducing concussion of the brain. He stunned a guinea-pig by passing a strong

electric shock through it from the head to the tail, and because the animal fell and convulsive movements of the extremities ensued, he arrived at this conclusion. But for my own part I do not see the least proof that more concussion falls upon the brain than upon any other part of the body. Equally little do I see that death ensues from paralysis of the heart's action, if by this be meant a specific and exclusive impression upon this viscus ; indeed one of Brodie's own experiments goes to show that any such arrest of cardiac movement is quite a secondary matter. On opening a guinea-pig which had been stunned by a strong electric shock, he found the heart three minutes after, acting with regularity and vigour, and the peristaltic motion of the intestines still going on. If however the explanation already suggested of swooning, namely that it is due to a sudden and great attraction of the vital power to the seat of vision and the part of the brain connected with it, the intensity of the responsive action corresponding exactly to that of the impression, plus the susceptibility of the person affected, be extended to the action of lightning, we have, I respectfully submit, something like a key to the mystery. A precisely similar explanation may be given of that once crucial question, the fluidity of the blood in an animal hunted to death, the vital power in such a case being so violently and persistently attracted to the brain, voluntary muscles and heart, that there is no pause long enough, and death takes place without there being time for the beginning of so vital an act as coagulation.

Suppose then figure 13 to represent a person in his ordinary state, A will stand for the brain, B for the heart,

ATTRACTION OF VITAL POWER BY LIGHTNING.

FIG. 13.—*Before the Shock.*FIG. 14.—*After the Shock.*

aorta and other great vessels, and C for the stomach, considered here to be the representative of the organic life structures. In figure 14 the shock caused by the impact of the lightning D, at E, has so entirely diverted the vital power from these parts to where it made its track along the surface, that they are no longer capable of executing any function, and the frame sinks motionless and lifeless to the earth. In order to exemplify the course of the violent and fatal excitement set up in the animal hunted to death, you have simply to substitute its figure for that of a man, to *transfer the seat of attracted vital power from the skin to*

the muscles, brain and heart, and you will have before you a plain definite idea. Hunter considered that in a person killed by lightning "there is an instantaneous and complete destruction of the vital principle in every part of the animal machine." Perhaps he really meant immediate and permanent arrest of all vital functions. I do not see that Hunter's description renders the problem any clearer, and it does not apply to minor degrees of shock, as is shown by Brodie's experiments, and the facts attendant upon recovery from the paralyzing effect of the lightning flash, in which we see that different parts of the "animal machine" are variously affected, consciousness being entirely suspended for some time, during which a certain amount of vital action is going on or death would follow.

Death from Poison.—The second class of such cases includes those where a poison like hydrocyanic acid is swallowed in sufficient quantity to cause instantaneous death. Having read through some of these histories, and having had an opportunity of personally investigating three of them, I feel justified in concluding that the beginning of death, the insensibility itself, if not every step in the fatal process, takes place before there has been time for the absorption of the fluid to such an extent as to reach the heart and brain ; indeed it is doubtful whether there is any absorption at all in some cases. Thus for instance a druggist emptied an ounce of the dilute acid into a wineglass, and having told his wife what he was going to do, instantly swallowed it in her presence, or at least as much as he could, for fatal insensibility came on before he got the whole of the draught down, and he died without making a

movement. We may therefore, I apprehend, fairly conclude that the acid acted here on the mouth, pharynx and stomach, much as the lightning in the foregoing sketch is supposed to act upon the surface of the shoulder.

Let then figure 15 stand for a person in the normal state, the stomach, heart, large blood vessels and brain, A B C and D, being represented by continuous lines. So soon however as the vital power is supposed to be attracted largely to the stomach, we have the state of matters represented at figure 16, that is to say increasing accumulation

ATTRACTION OF VITAL POWER BY PRUSSIC ACID.

FIG. 15.—*Before the Poison has been taken.*

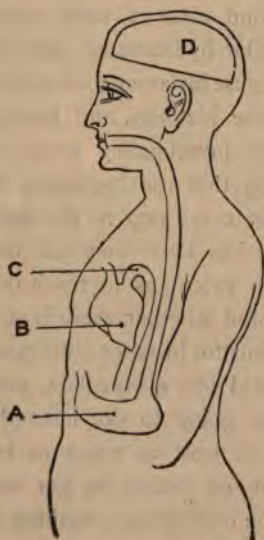
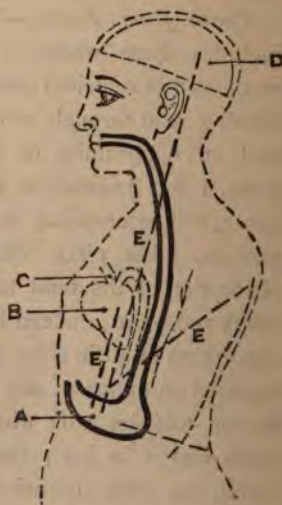


FIG. 16.—*After the Poison has been taken.*



of vital power at A, while the dotted lines at B C and D show a great deficiency, the slender lines at E E F being intended for imaginary tracks indicating the rush of vital power towards the stomach from other parts such as the brain, heart, spinal cord, muscles and so on. The cord however is not shown, because I wish to keep the diagram as simple as possible.

To the objection that a few, perhaps hastily observed, cases cannot be weighed against the host of facts showing that poisons are absorbed into the blood, it may be replied that very likely all medicines, sufficiently slow in their action, are taken up so far as their degree of solubility allows; but that this is a secondary matter, and that there is a certain amount of reason for believing the beginning and end of the process to be independent of this step. Thus from a case in the *Lancet* we learn that the patient took three quarters of an ounce of oxalic acid, but vomited the whole quantity back again except two grains, yet she died in ten minutes from the time of swallowing the poison. Now I think the firmest believer in absorption might here find evidence to stagger him in his creed, as most probably none of the salt was taken up into the blood, and the two grains only represented the loss and residuum left adhering to the fauces, gullet and stomach.

A similar absence of all visible proof of absorption has been noticed after death from methylin. Mr. Edwin Canton, when giving evidence before a jury respecting the death of a strong healthy man, who died quite suddenly under the influence of this agent while a finger was being removed, stated that nothing found at the post mortem examination

accounted for the fatal result, and that there was not a vestige of proof that the anæsthetic had acted on either the brain or heart. He added, what your experience will easily corroborate, that he had known death ensue from the mere shock of the operation, no chloroform having been given, a fact upon which, though it illustrates the vital power theory, I forbear to touch from a desire not to lengthen this lecture.

Some of Brodie's experiments are, I think, strongly in favour of the view taken by myself. He applied a drop of the essential oil of bitter almonds to the tongue of a young cat, and the animal was *instantly* seized with violent convulsions. He injected two ounces of proof spirit into the stomach of the rabbit. *The operation was scarcely over when the animal became perfectly insensible.* Brodie calls attention to the fact that belladonna, applied to one eye, dilates the pupil of it while the other eye remains unaffected; and hence considers that such substances as we have been speaking of act upon the brain without entering the circulation at all. There are indeed some poisons, woorara for instance, which seem only to influence the brain when they reach it through the blood vessels. But this simply proves, what men might easily learn without it, that poisons differ widely in their potency and solubility, and that if woorara, or any other toxic agent soluble enough, be inserted into a vein, it will be carried towards the heart and brain just as an innocuous fluid would be; not that all poisons act through the medium of the circulation. It shows that woorara possesses properties differing from those of prussic acid; that its nature is to affect the brain just as it is the

nature of arsenic, when introduced through a wound to act on the stomach and intestines, and that of chloride of barium, conveyed in the same way, to operate upon both the nervous and vascular systems.

Having now stated the reasons which seem to justify dissent from the view that poisons only act when they have been absorbed into the circulation, it may be as well to put the vital power theory to a more severe test, and assume that the accepted doctrine is right, because I wish to prove that such a fact, if fact it be, will not invalidate the views put forward in these lectures. Let it then be supposed that the poison is so far absorbed as to reach the heart. The next step will be to remind you of the attempt made to show that morbid agencies may assail one part of an organ more than others; indeed with reference to the stomach this is rather to be ranked among admitted facts, it being pretty clear that, while one poison will affect chiefly the muscular tissue and impel this viscus to violent efforts at expulsion, another will set up pain and so on. Pursuing the thread of the absorption theory, we must recollect that whatever part the poison attacks, the stomach or the blood, the course of its effects is still the same. Premising this, and selecting as an instance a narcotic poison, I must point out that the influence of a toxicant of this nature clearly extends to the muscles because the poisoned person falls, and to the brain because he becomes insensible. All this being kept in view, the accompanying diagram will be intelligible.

In figure 17 a person is drawn with the stomach, heart, large blood vessels and brain, A B C D, in a normal state,

ATTRACTION OF VITAL POWER BY NARCOTIC POISON.

FIG. 17.—*Before the Poison
has been taken.*

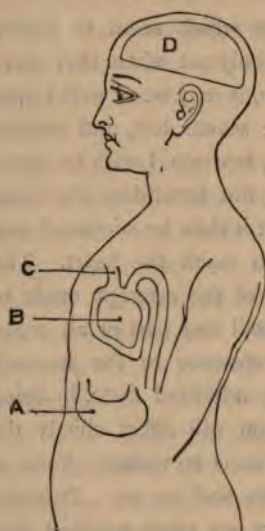


FIG. 18.—*After the Poison
has been taken.*



while figure 18 represents him after the poison has been so far absorbed as to reach the heart and there exerts its fatal influence, as shown by the darkening of the inner line at B, withdrawing all vital power from the parts represented in figure 17 as being amply supplied, now displayed in their drained state by the dotted lines at A C D, and even from the muscular structure of the heart itself, as pointed out by the breaking of the outer line at B.

It may be as well to pause here and remark, that even in cases where no absorption can well be imagined, we may

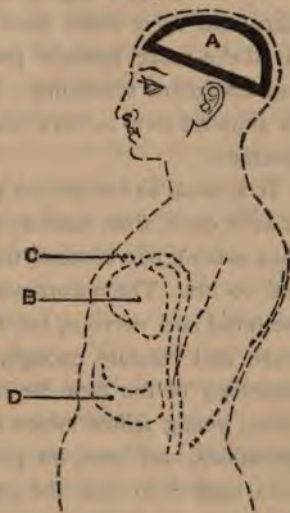
occasionally watch the operation of deleterious agents, which for our purpose might be classed with those just noticed, and I wish the more to call attention to them, because observation of the symptoms which they set up will exemplify the limitary law so often pointed out, it being fairly evident, even to an inattentive person, that just in proportion as these symptoms grow more severe, do those signs which indicate withdrawal of the vital power from the brain, &c., become more prominent. Thus Byron, after suffering from shell fish poisoning, says, "I remember in my illness the complete inertia and destruction of my chief mental faculties. I tried to rouse them—and yet could not." Had he tried he would most assuredly have found that his bodily faculties had gone or were going the same road; and that he could not at such a time have either swum the Hellespont or broken the stem of a wine glass with a pistol bullet. I therefore look upon this as an instance of withdrawal of vital power from the brain and muscles to the stomach, occasioned by an irritant substance not absorbed, and this reasoning I will try to clench by quoting an instance of directly reverse action, that is to say from the stomach to the brain, taken, by a coincidence, from the life of Byron's illustrious biographer, Thomas Moore. He was lying overpowered by sea-sickness, dreadfully ill as he expresses it, when he heard an alarming remark about his father, which filled him with such dread and agitation as at once checked the impulse to sickness, and he "remained for some time even without a qualm."

In the bite of a poisonous animal we have, united, all the conditions required to constitute a typical case in support

of the humoral zymotic theory, particularly with reference to the exanthems. Taking the two first stages of the zymotic process, the parallel is everything which could be desired; analogy here lends all her aid. The difficulty is that Nature will not lend hers, it being very probable that a great deal of what has been taken for granted about the absorption of the virus is purely imaginary, that this acts from the outset on the nervous system, most likely by dangerously attracting the vital power to the site of the lesion, and that the blood simply shares in the general disturbance. In 1809 a man, who had been bitten in the hand by a rattlesnake, was admitted into St. George's Hospital. The immediate effect of the injury was great constitutional disturbance, from which he gradually recovered. Then the limb became inflamed, and there was sphacelation of the cellular tissue as high as the middle of the arm, followed by suppuration. But in addition to this there were large spots of extravasation of blood in the subcutaneous texture, far beyond the limits to which the inflammation had extended. These were observable on the back as low as the hip joint, and on the anterior part of the chest over the pectoralis major and serratus anticus muscles, but *they were confined altogether to the side of the body on which the injury was inflicted*. This case evidently staggered Brodie who reports it. Firm believer in absorption as he was, he could not make the facts square with humoral pathology or blood-poisoning. The history, he says, "seems to show that the influence of certain poisons admits of being propagated to distant parts," "independently either of the nerves or the vascular system."

I pass over instances of death from swallowing suddenly large quantities of intoxicating liquor, which seem to me susceptible of the same explanation as the action of poisons, and I proceed to illustrate the theory by the sketch of a person imagined to be under the influence of violent anger. The effect of this is supposed to be shown by the accumulation of vital power in the brain at A, while the heart, aorta and stomach, B C D, are almost wholly deprived of it. The reason for giving only one figure here is to avoid swelling the bulk of these lectures, it being understood that the diagram represents, in its thickened and dotted lines, the departure from the natural state indicated by the simple curved lines used in the preceding diagrams. The same illustration will serve to convey an idea of the action set up in swooning, in insensibility supposed to be caused by the circulation of a large quantity of alcohol through the brain, as also, with selection of other seats, for the morbid influence of the action brought on by prolonged muscular exertion, intense thought and wearing pain.

FIG. 19.
*Attraction of vital Power by
Anger.*



In my judgment the results occasionally seen from the

shock of slight operations strongly fortify the postulate, that the essentials of even fatal disease are the impact of the hostile agent and the rush of vital power to the part assailed. A shock is inflicted on the frame followed by pallor, swooning, stopping of the pulse, prolonged insensibility and even death itself ; a series of actions identical in all the more material points with death from lightning and malignant scarlatina. The whole drama of disease in its simplest form is here played out before the eyes of the spectator.

It is usual to ascribe the great severity of symptoms seen in such cases, from causes so slight, to mobility of the nervous system, nervousness, timidity on the part of the patient and so on. The occurrence may be more frequent among the timid and nervous, but I have seen it in men who were brave and resolute enough, and who could not by any stretching of the term be called nervous. I have seen a strong young fellow swoon from one of the most trifling of operations, and have, on placing my finger upon the wrist, been unable to feel the pulse. Mobility of the nervous system seems, to my judgment, the same thing as mobility of the vital power, and the latter state to be better explained by the doctrine laid down in these lectures than by any other I have met with. In most of these cases there is some abnormal condition present, hidden or visible, which habitually but irregularly attracts the vital power from its natural channels to the seat of morbid action, and accordingly, when anything happens which occasions a sudden drain upon the vital power, this is felt with greater severity and quickness than in health. I would apply the explana-

tion offered of shock to death from burns and scalds. As to saying that the patient in the latter cases dies from congestion of the lungs caused by arrest of the perspiration, it may be met by remarking that the congestion, if present at all, can only be supposed to play a subordinate part; that the fatal issue ensues so rapidly in some instances that a special form of pneumonia must be invented to meet the difficulty, as the state which is to end in death begins within half an hour or so after the accident. The perspiration, except on the injured parts, is not checked more than in many cases of shock, and we do not find this congestion of the lungs in patients suffering from general ichthyosis, where the perspiration is arrested quite as extensively.

Generation and Expenditure of muscular Force.—But altogether pathology gives only a most unsatisfactory account of many of these things. The production of muscular force has been explained as if the writer could look into the interior of the living body and see the whole process going on. The senior physician of a London hospital expounded it when I was present as follows. "The muscular force," he said, "is generated from food taken into the stomach. Thus for instance I walk till I am tired; by this means I exhaust my stock of muscular energy. I sit down, eat and drink; then after a time I resume my walk with renewed vigour. Clearly therefore the source of the regained force is in the food, and it is secreted from this by the digestive apparatus just as bile is by the liver." I imagine no one doubts that a due supply of food is requisite to maintain the muscular strength at its proper standard. But the point at issue is, does this supply of food enable

some unknown structure to generate, almost at will, muscular force which is exhausted by labour, or does it simply keep in a healthy state the parts which are exerted when muscular power is set in motion; the agency being really vital power, partly attracted into the muscles from other regions, partly what is usually resident in them? The first of these views, that commonly accepted, is quite opposed to the second, which represents the doctrine of limitation and constant quantity.

It is difficult to conceive how under certain circumstances food can be digested, turned into chyle, and form the store from which muscular force is renewed. To speak more plainly the thing is impossible. A foot bath and change of socks, a chop and glass of sherry, all despatched within half an hour, have enabled pedestrians to renew a racing walk which they could not have got through without such aid, and which they must almost have finished before the digested food entered the lacteals. But admitting that muscular force is generated when food is taken, *what becomes of the superabundance when it is not carried off by exercise?* Thousands of persons consume daily, during idleness, twice as much food as is required by the pedestrian for prolonged and severe exertion. Men often go for weeks and even months, eating and drinking much as usual, taking very little exercise, and yet at the end of this time exhibit no signs of accumulation of muscular force, either in the shape of extra strength or any other shape. If the accepted theory mean anything at all, it must be that force, which is generated and not used up, accumulates, so that a man, who had rested thirty days, ought to be able to walk four or five

hundred miles at a stretch. Besides the theory totally fails to explain the sudden influx of extraordinary strength into the muscles under circumstances not at all favourable to the generation of force from food. Sir Thomas Watson says it will now and then take five or six stout men to hold a weak emaciated lad in a fit of epilepsy. Brodie mentions the case of a gentleman who had broken his arm, and who yet struggled so violently while in convulsions, that it was with difficulty several persons could hold him; while I perfectly remember a case, where a young and not very strong lad was so terrified at seeing a playfellow pulled down by a ferocious dog, that he vaulted from a garden seat over a wall, which I should have thought an active man could hardly have leaped.

If now we look at such facts with minds free from the bias of prejudice and tradition; if we view the epileptic seizure as an illustration of the law that every hostile agent, whether it comes from without or within, has its own individual action, and that in this disease the nature of the agent is to cause sudden withdrawal of vital power from the brain, and those muscles which keep the frame upright, and precipitate it into those which are engaged in the convulsive movements peculiar to this dire affection, we acquire a precise notion of the manner in which the train of abnormal actions may be supposed to take place. In the same way, if we assume, as I contend we are thoroughly justified in assuming, that the occurrence causing fright simply acts upon certain impressible portions of the brain, occasioning an immediate attraction thither of the vital power, sometimes so suddenly as to withdraw it from the

organ of reflection, whatever be the part of the brain in which this is located ; from the heart and muscles, as when it causes swooning ; sometimes into the heart and muscles bringing on violent palpitation and frantic efforts to escape, we also get a clearer view of the case.

Generation and Expenditure of nervous Force.—When we come to this process, we get a step nearer to a definite idea of what we are dealing with, for the seat of secretion is pointed out. It is in the grey matter of the brain and spinal cord, and Brodie, from whom I borrow, compares the process by which the generation of force is effected to that of the voltaic battery, but he does this with a reserve contrasting strongly with what he says about the expenditure of force, for of this he speaks as if it were a fact beyond dispute. But he offers no proofs, and I observe nothing in what he tells us which is not open to the objections raised in speaking of the generation and exhaustion of muscular power. Nor do I see anything more convincing in Sir Henry Holland's account. He maintains that expenditure of nervous force takes place, because in no other way can we adequately explain the progressive increase of irritability up to the moment of a fit, which so often occurs in an epileptic patient, and the almost entire absence of it which afterwards ensues. But this does not explain those cases in which a fit occurs without any accumulation of irritability ; it proves subsidence, not discharge ; and the want of any other explanation is a poor reason for accepting the one offered.

With this question is intimately connected one which we constantly hear about, the decay or destruction of the

vital power or powers. Not knowing what is meant by the word used in the plural, I restrict myself to the consideration of it in the first of these two senses, and I say unhesitatingly that I see no evidence of such a change ever taking place, nor do I understand how a principle can decay any more than any other quality of matter. The organs indeed through which it manifests itself may utterly degenerate, may become quite incapable of executing their functions, but that is a different question. Dr. Henry Bennett says he considers acute phthisis "to be evidence of a profound and final decay of vital power." But with the progress of consumption at the affected parts, the eroded pyogenic surfaces will extend in superficies, which is equivalent to increased action, and this means greater amount of vital power at the arena of mischief, be the source and seat of this force where and what they may. Then with subsidence of vital power in consumption in every part but the seat of mischief, and accumulation of it here, I see nothing which removes this disease from the rule of constant quantity.

Muscular and nervous Force not present in the Ovum.—Here we have nothing but a crude material, a kind of blastema, and a vivifying power to which you may give what name you like, but which I will for the sake of simplicity call the vital power. This must form the nerves and muscles since by a power they are formed, and it seems a strange complication, that what in the beginning constructs these organs and may be supposed to regulate their earliest impulses, must be assumed either to split up later into two or more distinct forces; or else, so soon as

the ovum has attained such development that the stomach can take food and the blood can renew exhausted force, to abnegate its functions, or finally to die out.

Unity of Forces in the Frame.—But indeed as we pursue the inquiry, the conviction that the forces in the frame are but one becomes overwhelming. If the arguments so far laid before you can be supposed to show anything, it is that the muscular, organic, assimilative, procreative and cerebral powers are the same thing. If the identity of the mind with the vital power has not been demonstrated; if it has not been proved that great development of the mind is adverse to much expansion of the animal system, and that the latter is fatal to extreme mental activity, much labour has been spent to little purpose. But I think it has been made presumable that these contending actions are only so many manifestations of one power, the varying expression of which is due to the varying structure of the organs through which it displays itself. Thus muscular action in the human frame can only take place where there is muscle; let the latter be removed or absorbed, let its physical condition be ruined by injury of the blood vessels and nerves which supply it and keep it healthy, and the power to move such a part, even for the purpose of saving life, is gone. Yet we feel assured that it would return could the muscles be restored, for we see this happen when their action is forcibly suspended for a time. What holds good of the muscles applies equally to the nerves; freeze, divide or dissect out a nerve and a corresponding result ensues. Without proper development and nutrition of the organs there is no power of *thought* or continuation of the species. Such illustrations

might be multiplied almost without number, but as no useful purpose could be served by lengthening the list, I gladly refrain from what is superfluous.

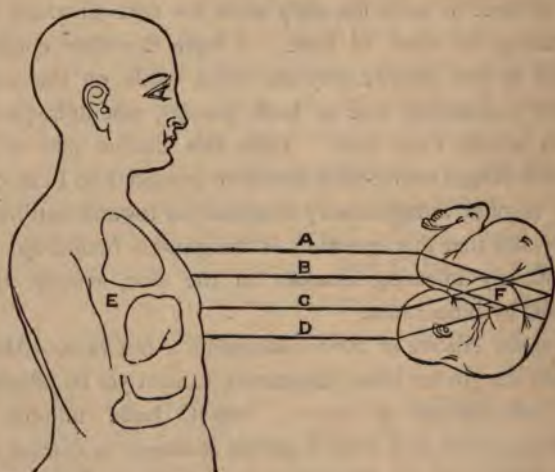
Influence of disordered Actions on Ovum.—We now come to the most abstruse problem of all, the causes of the direction of force in early life, only some few parts of which can be taken, for want of time. I have therefore confined myself to the inquiry why the child, while on the whole usually resembling one or both parents, not unfrequently differs widely from both. Even this limited part of the problem ranges over a wide extent of ground, and I can only hope to offer a fragmentary contribution towards settling it. I may add that this question is inseparably bound up with one closely affecting diseases of the skin, namely their descent by inheritance.

Complex Nature of Force communicated to Ovum.—Allowing full margin for hasty statements, it must yet be admitted that peculiarities of feature, height, bulk, number of children, genius and even a certain tendency to disease are, when they have not attained to overwhelming development in the father, often repeated in the child. The process of germination forbids us to believe that these are conveyed at the time of impregnation by representative groups of either fluids or solids, and we can therefore only fall back upon assemblages of "dispositions" or "impressions" issuing from the parent and conveyed to the ovum, to expand again in the foetus, just as luminous rays issuing from a large body are collected at the lens and cross each other behind it, to re-appear, inverted, on the retina. That some such action takes place admits I think of no doubt; the problem

is the machinery. With the latter however I have nothing to do, my business lying with the facts of the case.

FIG. 20.

Transmission of Impressions to Ovum. Normal State.

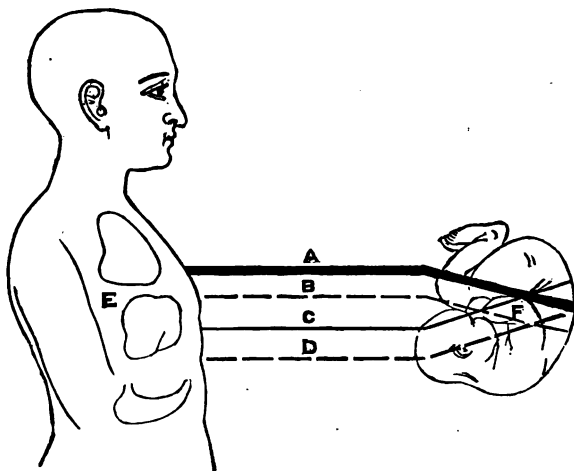


Let then in the accompanying diagram A B C and D emerging at points from the body E, represent the brain, animal life, organic life and procreative system. There being no disturbing cause present, all these systems are in equilibrium, and the result is that a fourfold normal influence is impressed upon the germ at F. But a strictly normal state is the exception, not the rule. We have to deal with disturbing causes, and it has been shown that one of these is excessive development in the parent. No fact is better

established than that some of the sons of great men have been the very reverse of their fathers, and this is the text chosen to work upon. Let then A B C D be again taken as standing for four sets of lines extending from parts denoting the brain, animal life, organic life and procreative

FIG. 21.

Transmission of Impressions to Ovum. Supposed Effect of increased Brain Activity on Animal Life and Procreative System.



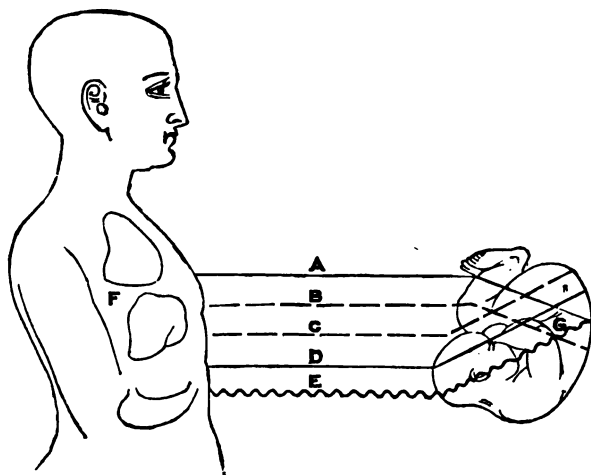
system, these points being integral parts of the body E, and joining at the germ F. The increased brain activity in the parent is shown by the thickened line at A, while the weakening of the two systems thus deteriorated is seen by the breaking of the lines at B and D.

The next diagram is much more complicated, the reason

being that it was necessary to examine also the question of disease, of course in its elementary form. That the latter is sometimes communicated direct and unchanged from the mother to the ovum we know, but the object must also be to inquire whether special disease in the father, when it exerts any particular strain upon the system, may not induce in the ovum a tendency to another malady; and whether a common disorder may not in its turn be the factor of a special disease in the germ, both of which my observations have led me to suspect, as also that particular development of growth or function in the parent may induce a tendency to disorder in the ovum. This possible form of disturbance is illustrated by the accompanying diagram, disease as

FIG. 22.

Transmission of Impressions to Ovum. Supposed Effect of Disease on Animal and Organic Life.



issuing from the parent being represented by a waving line. I am aware that this may seem very fanciful, but it is to be remembered that such modes of conveying ideas are employed with advantage both in science and art, as for instance in chemistry and heraldry, and that some system must be used. The diagram, too, is very imperfect; properly there should be a series of schemes representing the effect of the disturbing influence on all the organs, but time will not allow of this. In this figure then, as in its immediate predecessor, A B C and D stand for the brain, animal life, organic life and procreative system. Disease E, hitherto at zero, has now entered into activity, and its influence is seen exerted at the cost of the animal and organic life, B C, which may fairly be considered as frequently suffering in these cases, and which are consequently represented by broken lines, though I need scarcely say that such a selection of affected parts is purely arbitrary. The other points do not seem to require any explanation.

We have, it is to be remembered, one indisputable fact to go upon, the influence of great animal or cerebral development in the father, showing itself in the form of abnormal or even utterly opposed action in the child. But it is very doubtful if we can regard this as even a possible factor in the genesis of diseases of the skin; there is no evidence that the children of such parents are more liable than others to these affections. It is probable that some of the more persistent and developed forms of cutaneous maladies, especially those of them which partake rather of the nature of growth than of disease, such as lepra and ichthyosis, occasionally act in some slight degree like un-

usual size of the bones and muscles upon the offspring, and this possibly holds good of extensive hirsuties. In some cases of severe lepra in the parent I found the children few and weakly. In the only case of hereditary ichthyosis entered in my department at this hospital there was but one child in the family, though the parents had been many years married. In the remarkable instance of spiny ichthyosis communicated to the Royal Society as the history of the porcupine man, five out of the six children born to him had died by the time the second account was handed in; and judging from the total silence about what once excited so much attention, the sixth one most probably died young and had no offspring. The Russian, exhibited a few years ago, as such a remarkable instance of hirsuties, had, I believe, only one child, a son.

But there is no proof that the conditions are reversed, and we must seek for the causes of diseases of the skin in the children, among those circumstances and events of life which are continually operating upon the health of the parents. Cutaneous maladies are, moreover, far too common to derive their origin from causes so exceptional as unusual bulk or eminence, extensive disease or deformity in the parent. The race perishes under the weight of these, as regards the first two factors frequently, possibly as concerns the two last; disease of the skin affects the comfort and well being of only a member or two of a family. In the common injurious agencies of daily life then lies our chance of finding the possible causes of these complaints, and numerous as we might suppose these agencies to be, *they still admit of being resolved into groups.* These are

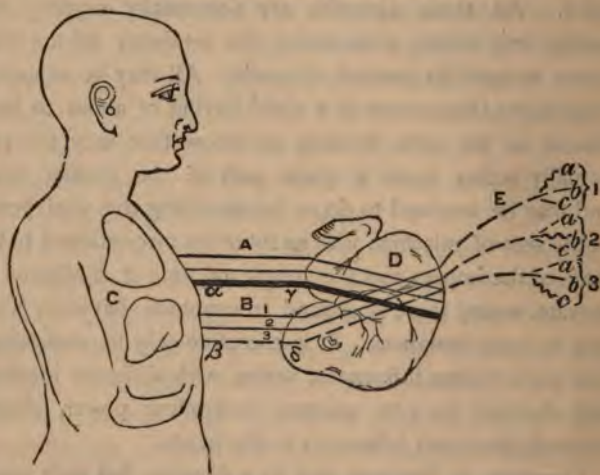
the action of foul air, atmospheric, epidemic and endemic states ; injurious trades ; bad living, over living, intemperance ; anxiety and over work, and lastly illness. I have seen good reason to believe that, however diversified the operation of these upon the parent, that upon the germ is often identical ; for instance many injurious trades, producing most dissimilar effects upon the father or mother, may be equally the cause of eczema, lepra or strumoderma in the child. All these agencies are perpetually sapping the health, and slowly overcoming the tendency of the vital power to seek its natural channels. All may be supposed to act upon the parents of a child having or about to have disease of the skin, because we know that they are perpetually acting upon a great part of the human race ; and may be assumed to do so by attracting the vital power to the seat of mischief, with an intensity proportioned to the force of the impact and the length of time it is allowed to operate, seeing there is ground to conclude that such is the case in many instances. It is therefore easy to understand how such various influences, acting with different intensity and checked by very unequal controlling power, should transmit dissimilar influences to the ovum.

I propose to illustrate this by a diagram, but as it would be most confusing to crowd all these disturbing influences into the same field, it will be better to select one only, the effect produced by overwork of the brain or anxiety, and this too only so far as it effects the animal system. Those who may wish to pursue the search farther will find little difficulty in doing so ; my object is if I can to point out the path. For the purpose of showing the view now pro-

pounded, the lines issuing from the brain and animal life, instead of being single as before, are now triple, and the influence conveyed from the parent to the germ is supposed, after having passed through a focus, to radiate into the

FIG. 23.

Transmission of Impressions to Ovum. Supposed Effect of increased Brain Activity on Bones, Skin, and Nerves.



several structures of the latter. In order however to make the diagram still more simple, the bones, nerves and skin in the germ are shown by simple lines, dividing, after the impression has been conveyed to them, into different groups.

The diagram is to be read thus. Let A stand for three lines of influence emanating from the brain, and B for a similar number from the structures of animal life; the ex-

cited action of one part of the brain is supposed to be shown by the darkening of one line at $\alpha \gamma$, while the disturbed impression made upon one part of the animal life is pointed out by the broken line $\beta \delta$. Of course it is to be understood that other deranging influences in the parent C may operate in a similar manner. E shows the ultimate effect of this excess of action in one part, and broken action in the other, and how this effect, gathered into a focus in the germ, expands again after birth. The later growth of this, the germ, displays the perturbed state of the parent prolonged to the same three groups in the child; for instance E 1 is the prolongation of B affected by A $\alpha \gamma$. Each of the three lines of B diverges again at E into three more lines $a b c$, 1 2 3. Of each of these three terminal groups again, one line is curved to show abnormal or diseased action in the child, the other two lines being normal. Consequently as each of the primary life lines comes into activity with the growth of the germ, the disturbed action of B, derived it is to be remembered from disturbing action at A, after passing through D will show its influence at E, on the bones at a 1 the skin b 2, or the nerves c 3.

One reason why I believe that common factors are chiefly if not entirely concerned in the genesis of diseases of the skin, perhaps of all diseases, is that the cause and effect seem to bear such a close relationship to each other, not only as regards their importance but their numerical position. We see too no other causes, and some cause there must be. We know that in a given number of the population we shall always find a certain number exposed more than others to the deteriorating effects of the agencies just enumerated,

and we also know that we shall, partly if not wholly as a result of this, meet with a certain proportion of ill-health. That some such connexion exists seems to me an unavoidable inference. The regularity with which, in proportion to the main mass of the people, certain forms of skin disease occur, more resembles that with which the common unnoticed wants of life demand relief, than anything so erratic as we are accustomed to consider disease. If we take a thousand persons in the average state of illness represented by those seen in the out patients department of any large hospital, we shall find one in every twelve or thirteen suffering from disease of the skin. Of these among themselves a large number occur with such regularity as disposes of all doubt, and what is perhaps strangest of all, even the contagious and so-called contagious forms of skin disease always bear much the same proportion to other cutaneous maladies and to each other.

Hereditary Nature of Disease of the Skin.—It will be superfluous to say that this usually figures as a powerful factor in the genesis of affections of the skin. I scarcely know how to speak of the doctrine, but I may begin by saying that the belief in the theory of descent seems fairly strong in proportion to the weakness of the evidence; and that the great difficulty in dealing with it appears to be, not the want of rebutting testimony but the practical impossibility of gaining a fair hearing for this. With many persons at least, the belief, that disease is hereditary, is clearly enough one of the forms of thought into which the human mind will gravitate, and about which it has never yet listened to reason. Vague as may be the idea which the phrase is in-

tended to convey, its tenacious hold makes it difficult to cope with, and that it is vague we may feel assured, because of those who employ the term, not one in twenty distinguishes between a disease being hereditary and inherited, between a quality and an accident. Yet every scrap of evidence in favour of this elastic creed is at once accepted as gospel, and looked upon as a cherished contribution to our stock of knowledge. Men have no misgivings here as to either their facts or their conclusions, and any questioning on the subject would be sheer waste of time, for it would be looked upon as implying either a doubt of the speaker's veracity, or a disposition to cavil at facts which no man in his senses would dispute.

Still I must remind you that many a now exploded creed has in its day enjoyed a wide spread reign, only too often based on credulity and defended by intolerance. Consequently, prevalent as the belief may be, I will not hesitate to appeal from it to facts, and I say at once that the facts observed in my department in this hospital lend no countenance to the common opinion. For years I watched carefully in support of a view which I had been taught in my younger days to consider impregnable, but when the question came to be thoroughly sifted, it turned out that sometimes in a thousand cases of skin disease of constitutional origin, there were not more than five or six instances of the same affection occurring in both parent or child. Leprosy, which has been considered such a stronghold of the descent theory did not yield more than one case in thirty five of transmission; and ichthyosis, the hereditary nature of which was asserted before the

Royal Society and apparently without a murmur of dissent, only gave one in thirty six. Even this amount of transmission seems very questionable. It should never be forgotten, though the advocates of the doctrine have so thoroughly overlooked it, that unless we assume our common ancestors to have been affected with all possible forms of skin disease, every one of these must have begun with some person, and therefore, that what happened once may happen again, and that too as easily among the children of parents with lepra as of healthy persons. For all such reasons I think that descent may very well be relegated to the class of common factors;—that we must regard the presence of skin disease in the parent as only one of many perturbing causes, which cast their shadow upon the ovum, and impress upon it that tendency to disease which may be evoked by many causes or slumber through life; and that both predisposing and exciting causes act in the same way.

Organisms.—You will perhaps ask me if I mean to pass by without a thought or a word the labours of so many eminent men, the hosts of experiments, about organisms; the diseases they set up; the agency by which their destructive effects are carried out; their birth and growth; their multiplication within the human frame, and their ultimate decay or destruction. I have no wish to evade the subject, but it equally forms no part of my task to touch upon it, for it has nothing to do with the matter in hand, and does not enable us to solve one of the topics we have been discussing. That anything yet made out about these bodies establishes the doctrine of zymosis, or justifies the

fitness of the Registrar-General's term for the contagious exanthems, I must respectfully deny. Even in Dr. Burdon Sanderson's comprehensive and luminous digest of what has been done in this direction during the last fifty years, I fail to see one iota of proof that in contagious fever a blood-poison enters the frame, multiplies there and is thrown out by the eruption.

It may be very interesting to cultivate septic discharges in cucumber infusion or albuminated water ; to raise a good stock of micrococci and bacteria, and describe their shape and movements under the microscope ; but however valuable such experiments may be in the eyes of the physiologist, not a single conclusion can be drawn from them which in the least affects the arguments I have had the honour to lay before you ; or which in any way supports the doctrine that in scarlatina or smallpox, a poison multiplies in the blood after the same fashion as a different poison does in a fluid differing from the blood in every feature of importance. At the utmost the artificial generation of such bodies only proves, that matter, thrown off from unhealthy surfaces, can be nursed into certain low forms of organic life, similar to those seen occasionally in portions of the human body undergoing, in consequence of disease or injury, somewhat analogous forms of deterioration. Nor do I see that the discovery of organisms of like or unlike kind, whether it be in the mud of the pontine marshes or the street sweepings of New Orleans, in expectoration or breath deposit, is at all more likely to furnish us with a key to the mystery of exanthematous disease. Blood-poisoning also I leave on one side ; it will be time enough to discuss it when we are

told what the toxic agent really is, how it gets into the body and what pathological change it induces in the blood.

Perhaps it is not over judicious to criticize adversely a mode of reasoning, a fashion in physiology, which seems to meet with well-nigh universal favour. He who could flatter himself that such a task was to be anything but thankless would be very sanguine. What runs counter to the prevailing mode of thought is seldom acceptable, and the tendency of the age is evidently to think that the discovery of a new organism, or even of an old one in a new place, means a prodigious stride in physiology. Even a half-fledged discovery, massacred almost in the period of incubation or exploded in the very hour of its birth, will serve for the basis of a hypothesis which is to extinguish the physiology of former times. A very moderate amount of observation, which need not even be original, will answer all needful purposes; and then by dint of feeling assured that corroborating facts will some day or other be met with, of straining analogy so hard that the wonder is it does not snap under the tension, of ignoring or denying all objections, and assuming all that is wanting, a large amount of very innocent scientific fervour is safely let off, and a most satisfactory theory is erected, which lasts till some original experimenter gives another turn to the current of professional opinion, and thus provides material for new theories, whereupon the once omnipotent favourites are forthwith deposed and executed.

Nature of the vital Power.—I presume you will expect me to say a few words upon the essential nature of the power so often invoked in these lectures. I have however

no suggestions to offer on this head, but I must remind you that ignorance of the intimate nature of electricity and gravitation never yet withheld men from studying the operation of these stupendous forces. I imagine the vital power to be different from any other, because I do not see in any other department of Nature such effects as may be ascribed to it ; and I assume it to be impressed upon the matter of which our race is made, because each separate being executes for a limited time, certain functions which mere material could not perform without power. To reproduce, even in the most compendious form, the various conjectures about what its essence is, would be downright waste of time, and perhaps a modern and popular way of dealing with the difficulty, that of burking the whole subject, would be the most convenient if it had either truth or reason on its side. But it has neither the one nor the other, and it is in so far consistent that it appeals to neither, being simply a denial of principles which some of our best observers have agreed to believe. It affirms that vitality "is a nonsensical fiction" which can "neither be weighed, measured nor conceived to exist," and that physiology is simply a very complex branch of physics. I should say it was so very complex that the author of this wonderful theory would be rather puzzled to explain, by means of anything which could fairly be called physics, how it happens that chemistry cannot evoke even an approach to vegetable or animal matter in its simplest shape ; that no really intermediate grade between the vital and inorganic world has ever yet been found ; that such a difference, as is manifested by the almost entire want of reparative power after injury on the one side, and its high

development on the other, should exist between even the lowest forms of vegetable and animal life, as though Nature had determined from the very first to sever them by an impassable line of demarcation ; and lastly why organic life should manifest such an irrepressible tendency to propagation of race, to constant extinction of old forms of life and production of new ones, to limitation of size and age, and finally, in the animal kingdom, to the development of instincts, passions and genius ; while everything in the inorganic world, which can in any way be paralleled with these, exhibits a disposition the very reverse.

